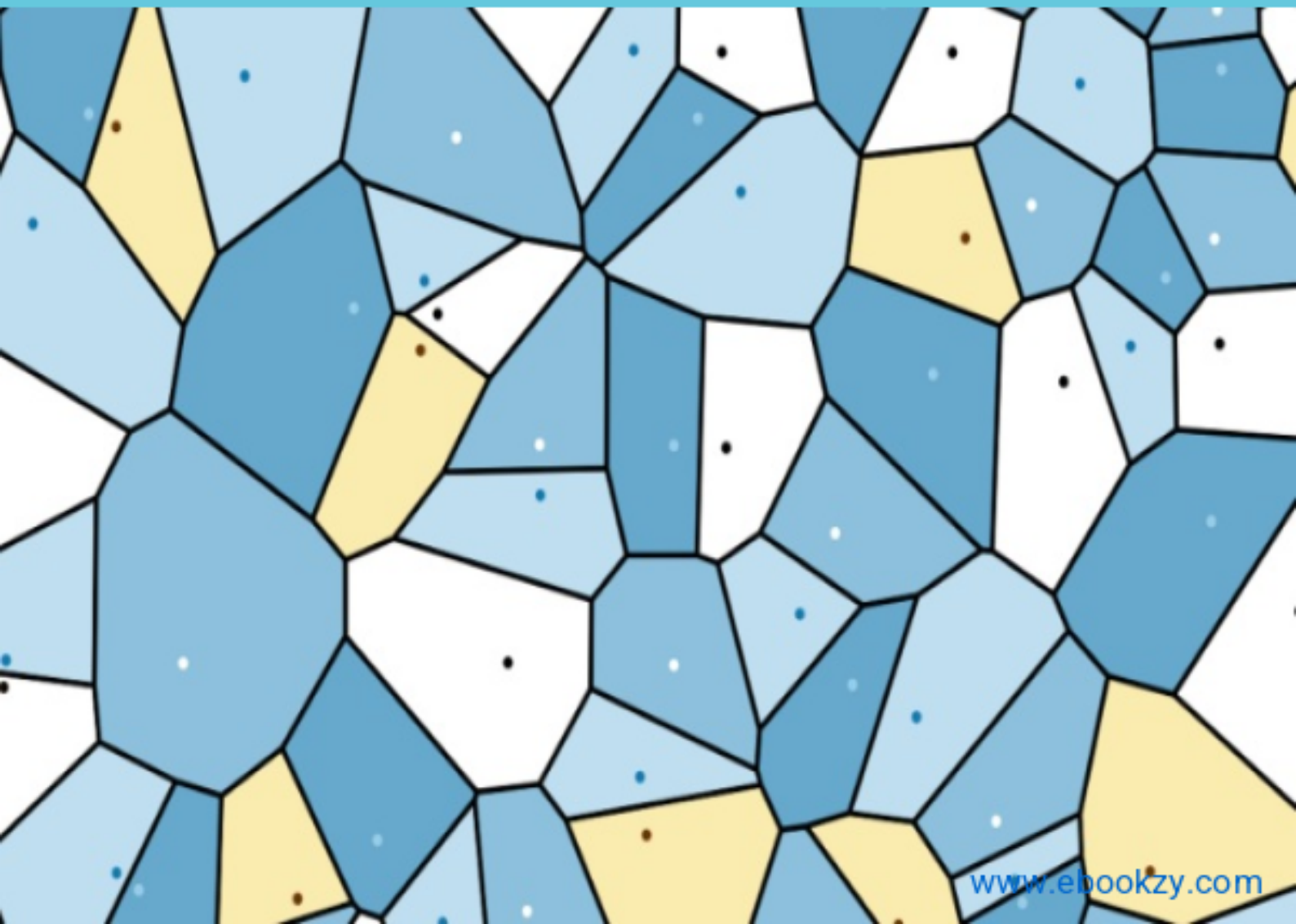
TRAVELS IN PERU AND INDIA

By Sir Clements R. Markham



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--A larger version of some images is obtained by clicking on them.
--Footnotes have all been moved to the end of the text.
--Silently corrected palpable typos.
--Variations in hyphenation have been maintained.
--Assumed printer's errors have been corrected.

HINCHONA-PLANTS AT OOTACAMUND,
In August 1881 (from a Photograph). A flowering branch of Chinchona in the foreground.
FRONTISPIECE. **Page 487**

TRAVELS
IN
PERU AND INDIA.

WHILE SUPERINTENDING THE COLLECTION OF CHINCHONA
PLANTS AND SEEDS IN SOUTH AMERICA, AND
THEIR INTRODUCTION INTO INDIA.

By CLEMENTS R. MARKHAM, F.S.A., F.R.G.S.,

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AUTHOR OF 'CUZCO AND LIMA.'

WITH MAPS AND ILLUSTRATIONS.

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PREFACE.

THE introduction of quinine-yielding Chinchona-trees into India, and the cultivation of the "Peruvian Bark" in our Eastern possessions, where that inestimable febrifuge is almost a necessary of life, has for some years engaged the attention of the Indian Government. In 1859 the author of the present work was intrusted, by the Secretary of State for India in Council, with the duty of superintending all the necessary arrangements for the collection of Chinchona-plants and seeds of the species esteemed in commerce, in South America, and for their introduction into India. This important measure has now been crowned with complete success, and it is the object of the following pages to relate the previous history of the Chinchona-plant; to describe the forests in South America where the most valuable species grow; to record the labours of those who were engaged in exploring them; and to give an account of all the proceedings connected with the cultivation of Chinchona-plants in India.

In the performance of this service it was a part of my duty to explore the forests of the Peruvian province of Caravaya, which has never yet been described by any English traveller; and the first part of the work is occupied by an account of the various species of Chinchona-plants and their previous history, a narrative of my travels in Peru, and a record of the labours of the agents whom I employed to collect plants and seeds of the various species of Chinchonæ in other parts of South America.

The traveller who ascends to the lofty plateau of the Cordilleras cannot fail to be deeply interested in the former history and melancholy fate of the Peruvian Indians; and some account of their condition under Spanish colonial rule, and of the insurrection of Tupac Amaru, the last of the Incas, will, I trust, not be unwelcome. I have devoted three chapters to these subjects, which will form a short digression on our way to the Chinchona forests. I am indebted to the late General Miller, and to Dr. Vigil, the learned Director of the National Library at Lima, for much new and very curious material throwing light on that period of Spanish colonial history which includes the great rebellion of the Peruvian Indians in 1780.

The second part of the work contains a narrative of my travels in India, a description of the sites selected for Chinchona-plantations, and an account of the progress of the experimental cultivation of those inestimable trees, from the arrival of the plants and seeds, early in 1861, to the latest dates.

In conducting the operations connected with the collection of Chinchona-plants and seeds in South America, I obtained the services of Mr. Spruce, Mr. Pritchett, Mr. Cross,

and Mr. Weir; and it affords me great pleasure to have this opportunity of publicly recording their perseverance in facing many dangers and hardships, and in doing the work that was allotted to them so ably, and with such complete success.

To Mr. Richard Spruce, an eminent botanist who has for eight years been engaged in exploring the basin of the Amazons, from Para to the peaks of the Quitenian Andes, and from the falls of the Orinoco to the head-waters of the Huallaga, the largest share of credit, so far as the South American portion of the enterprise is concerned, undoubtedly belongs. I have endeavoured to do justice to his untiring energy and zeal, and to the important service which he has rendered to India.

But the collection of plants and seeds in South America, and their conveyance to the shores of India, would have been of little use if they had not been delivered into competent hands on arriving at their destination. To the scientific and practical knowledge, the unwearied zeal, and skilful management of Mr. McIvor, the Superintendent of the Government Gardens at Ootacamund, on the Neilgherry hills, is therefore due the successful introduction of Chinchona-plants into India. His care has now been fully rewarded, and the experiment has reached a point which places it beyond the possibility of ultimate failure.

I am indebted to Sir William Hooker, who has, from the first, taken a deep interest in this beneficial measure, for many acts of kindness, and for his readiness to give me valuable advice and assistance; while he has rendered most essential service in successfully raising a large number of Chinchona-plants at Kew. To Dr. Weddell my thanks are due for much information most promptly and kindly supplied; and to Mr. Howard for the important suggestions and information with which he has frequently favoured me, and which no scientific man in Europe is better able to give. It is a fortunate circumstance that his invaluable and superbly illustrated work on the Chinchona genus should have been published just at the time when the Chinchonæ are about to be planted out in India and Ceylon, for from no other source could the cultivators derive so large an amount of valuable information. Mr. Howard has likewise done good service by presenting the Indian Government with a fine healthy plant of *Chinchona Uritusinga*, a species which had not previously been introduced. I take this opportunity of expressing my thanks for much assistance from Dr. Seemann, the able Editor of the 'Bonplandia;' from Mr. Dalzell, the Conservator of Forests in the Bombay Presidency; from Dr. Forbes Watson, the Reporter on the vegetable products of India, at the India Office; from Mr. Veitch, of the Royal Exotic Nursery at Chelsea; and from many kind friends both in Peru and India. I am also indebted to Mr. Alexander Smith, son of Mr. John Smith, the Curator of the Royal Botanical Gardens at Kew, for an interesting note on the principal plants employed by the natives of India on account of their real or supposed febrifugal virtues, which will be found in an Appendix.

The botanical name for the plants which yield Peruvian bark was given by Linnæus, in honour of the Countess of Chinchon, who was one of the first Europeans cured by this priceless febrifuge. The word has been generally, but most erroneously, spelt *Cinchona*; and, considering that such mis-spelling is no mark of respect to the lady whose memory it is intended to preserve, while it defeats the intention of Linnæus to do her honour, I have followed the good example of Mr. Howard and the Spanish botanists in adopting the correct way of spelling the word—*Chinchona*.[1] The Counts of Chinchon, the hereditary Alcaides of the Alcazar of Segovia, do not hold so obscure a place in history as to excuse the continuance of this mis-spelling of their name.

After much anxiety, extending over a period of three years; after all the hardships, dangers, and toils which a search in virgin tropical forests entails; and after more than one disappointment, it is a source of gratification and thankfulness that this great and important measure, fraught with blessings to the people of India, and with no less beneficial results to the whole civilized world, should have been finally attended with complete success, in spite of difficulties of no ordinary character. How complete this success has been, will be seen by a perusal of the two last chapters of the present work, and of Mr. McIvor's very interesting Report in the Appendix; it is sufficient here to say that it has exceeded our most sanguine expectations.

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POSTSCRIPT.

OCT. 16, 1862.

LATEST INTELLIGENCE OF THE CHINCHONA PLANTS, FROM THE NEILGHERRY HILLS.

Number of Chinchona plants on the Neilgherry Hills on August 31st, 1862.

Species.	Number.
C. Succirubra	30,150
C. Calisaya	1,050
C. Condaminea (var. *Uritusinga*)	41
C. Condaminea (var. *Chahuarguera*)	20,030
C. Condaminea (var. *Crispa*)	236
C. lancifolia	1
C. nitida	8,500
C. micrantha	7,400
C. Peruviana;	2,295
Species without name	2,440
C. Pahudiana	425
Total	72,568[2]

The total number of plants permanently placed out in the plantations, on August 31st, 1862, was 13,700, and, although only recently transplanted, they are in a very promising condition. The number placed out, at the same date, in the nurseries in the open air, and in the hardening-off frames, was 18,076, all in the finest possible state of health. The number of small plants under glass, including those used for the production of wood for propagation, was 40,792.

There are four plantations for Chinchona cultivation, either cleared and planted, or about to be cleared, at Neddiwuttum and Pycarrah; besides the loftier one at Dodabetta. At Neddiwuttum the "Denison Plantations" will contain about 210 acres of planted land, the "Markham Plantation" about 200 acres; and near Pycarrah about 250 acres are to be planted, of fine well-watered land, completely sheltered from the west winds, to be called the "Wood Plantation," after the Secretary of State for India: altogether about 660 acres, besides the Dodabetta site.

Plants are to be disposed of to private individuals who may be desirous of undertaking the cultivation, and 22,000 had already been ordered in the beginning of September.

LATEST INTELLIGENCE FROM DARJEELING.

Dr. Anderson, who is in charge of the Chinchona cultivation in Bengal, brought the plants to the Darjeeling Hills early in May 1862. He then had 84 plants of *C. succirubra*, 44 of *C. micrantha*, 48 of *C. nitida*, 2 of *C. Peruviana*, 5 of *C. Calisaya*, and 53 of *C. Pahudiana*. On July 26th these had been increased, by layers and cuttings, to 140 of *C. succirubra*, 53 of *C. nitida*, 43 of *C. micrantha*, 7 of *C. Calisaya*, and 3 of *C. Peruviana*. *See page 512.*

LATEST INTELLIGENCE FROM CEYLON.

On July 29th, 1862, Mr. Thwaites had raised 960 young plants of *C. Condaminea* from seeds. At the same date the plants of *C. succirubra* were thriving admirably, several being planted out in the hill garden, and a few at Peradenia. The other species were doing well, and Mr. Thwaites was propagating as fast as possible from cuttings. *See page 509.*

C. PAHUDIANA.—The Dutch Species.

The *C. Pahudiana*, which forms the bulk of the Java plantations, is now generally acknowledged to be worthless. A tree of this species has been chemically analyzed by Professors G. F. Mülder and F. A. W. Miquel, and, in consequence of the joint report of these gentlemen, the Dutch Government have determined to put an entire stop to its cultivation. *See page 56. See letter from M. Hasskarl, dated May 23rd, 1862.*

TRAVELS IN PERU.

CHAPTER I.

DISCOVERY OF PERUVIAN BARK.

The Countess of Chinchon—Introduction of the use of bark into Europe—M. La Condamine's first description of a *Chinchona*-tree—J. de Jussieu—Description of the Chinchona region—The different valuable species—The discovery of quinine.

THE whole world, and especially all tropical countries where intermittent fevers prevail, have long been indebted to the mountainous forests of the Andes for that inestimable febrifuge which has now become indispensable, and the demand for which is rapidly increasing, while the supply decreases, throughout all civilized countries. There is probably no drug which is more valuable to man than the febrifugal alkaloid which is extracted from the chinchona-trees of South America; and few greater blessings could be conferred on the human race than the naturalization of these trees in India, and other congenial regions, so as to render the supply more certain, cheaper, and more abundant.

It will be the principal object of the following pages to relate the measures which have been adopted within the last two years to collect plants and seeds of these quinine-yielding chinchonæ, in the various regions of South America, where the most valuable species are found; and to give an account of their introduction into India, and of the hill districts in that country where it is considered most likely that they will thrive. But it is necessary that the reader should have a general knowledge of these precious trees, and of their history, before he accompanies the explorers who were sent in search of them over the cordilleras of the Andes, and into the vast untrodden forests.

It would be strange indeed, if, as is generally supposed, the Indian aborigines of South America were ignorant of the virtues of Peruvian bark; yet the absence of this sovereign remedy in the wallets of itinerant native doctors who have plied their trade from father to son, since the time of the Incas, certainly gives some countenance to this idea. It seems probable, nevertheless, that the Indians were aware of the virtues of Peruvian bark in the neighbourhood of Loxa, 230 miles south of Quito, where its use was first made known to Europeans: and the Indian name for the tree *quina-quina*, "bark of bark," indicates that it was believed to possess some special medicinal properties.[3] The Indians looked upon their conquerors with dislike and suspicion; it is improbable that they would be quick to impart knowledge of this nature to them; and the interval which elapsed between the discovery and settlement of the country and the first use of Peruvian bark by Europeans may thus easily be explained.[4] The conquest and subsequent civil wars in Peru cannot be said to have been finally concluded until the

time of the viceroy Marquis of Cañete, in 1560; and J. de Jussieu reports that a Jesuit, who had a fever at Malacotas,[5] was cured by Peruvian bark in 1600. M. La Condamine also found a manuscript in the library of a convent at Loxa, in which it was stated that the Europeans of the province used the bark at about the same time. Thus an interval of only forty years intervened between the pacification of Peru and the discovery of its most valuable product.

It may be added, however, that though the Indians were aware of the febrifugal qualities of this bark, they attached little importance to them, and this may be another reason for the lapse of time which occurred before the knowledge was imparted to the Spaniards. Referring to this circumstance La Condamine says, "Nul n'est saint dans son pays." This indifference to, and in many cases even prejudice against the use of the Peruvian bark, amongst the Indians, is very remarkable. Poeppig, writing in 1830, says that in the Peruvian province of Huanuco the people, who are much subject to tertian agues, have a strong repugnance to its use. The Indian thinks that the cold north alone permits the use of fever-bark; he considers it as very heating, and therefore an unfit remedy in complaints which he believes to arise from inflammation of the blood.[6] Humboldt also notices this repugnance to using the bark amongst the natives; and Mr. Spruce makes the same observation with respect to the people of Ecuador and New Granada.[7] He says that they refer all diseases to the influence of either heat or cold; and, confounding cause and effect, they suppose all fevers to proceed from heat. They justly believe bark to be very heating, and hence their prejudice against its use in fevers, which they treat with *frescos* or cooling drinks. Even in Guayaquil the prejudice against quinine is so strong that, when a physician administers it, he is obliged to call it by another name.

In about 1630 Don Juan Lopez de Canizares, the Spanish Corregidor of Loxa, being ill with an intermittent fever, an Indian of Malacotas is said to have revealed to him the healing virtues of quinquina bark, and to have instructed him in the proper way to administer it, and thus his cure was effected.

In 1638 the wife of Luis Geronimo Fernandez de Cabrera Bobadilla y Mendoza, fourth Count of Chinchon, lay sick of an intermittent fever in the palace at Lima. Her famous cure induced Linnæus, long afterwards, to name the whole genus of quinine-yielding trees in her honour *chinchona*. The godmother of these priceless treasures of the vegetable kingdom has, therefore, some claim upon our attention.

This Countess of Chinchon was a daughter of the noble house of Osorio, whose founder was created Marquis of Astorga by Henry IV., King of Castille. The eighth marquis, who died at Astorga in 1613, had a daughter by his wife Dona Blanca Manrique y Aragon, named Ana,[8] born in 1576; and the ruins of the palace in the curious old town of Astorga, in which she passed her childhood, are still standing.[9] At the early age of sixteen she was married to Don Luis de Velasco, Marquis of Salinas, who was about to

assume the important office of viceroy of Mexico. She probably accompanied her husband to Mexico, and afterwards to Lima, as he was viceroy of Peru from 1596 to 1604. In the latter year he resumed his former office in Mexico, and, on his return to Spain, he became President of the Council of the Indies from 1611 to 1617.[10] The lady Ana had thus been a great traveller, when, in the latter year, she found herself a widow. In 1621 she was married, in the city of Madrid, to her second husband the fourth Count of Chinchon, who was descended from a long line of proud and valiant Catalonian ancestors. One of his forefathers, Don Andres de Cabrera, who was created Marquis of Moya in 1480, married Beatriz de Bobadilla, so well known in history as the faithful attendant and confidential friend of Queen Isabella the Catholic. The Emperor Charles V., remembering the services and ancient dignity of the illustrious families of Cabrera and Bobadilla, created the second son of the Marquis of Moya, by Beatriz de Bobadilla, Count of his town of Chinchon, in the kingdom of Toledo, in 1517.[11] The third Count was one of the over-worked ministers of that most indefatigable of "red-tapists" Philip II.; and his son became the husband of the widow Ana, who accompanied him to Lima on his appointment as viceroy of Peru in 1629. Thus, for the second time, this lady entered the City of the Kings as Vice-Queen.

While the Countess Ana was suffering from fever in 1638, in her sixty-third year, the Corregidor of Loxa, Don Juan Lopez de Canizares, sent a parcel of powdered quinquina bark to her physician, Juan de Vega, who was also captain of the armoury, assuring him that it was a sovereign and never-failing remedy for "tertiana." It was administered to the Countess and effected a complete cure; and Mr. Howard is of opinion that the particular plant which had this honour, and which, therefore, yields the true and original Peruvian bark, is the *Chahuarguera* variety of the *C. Condaminea*.[12] This kind contains a large percentage of *chinchonidine*, an alkaloid, the great importance of which is only now just beginning to be recognised, so that it is to *chinchonidine*, and not to *quinine*, that the Countess's cure is due.[13]

The Count of Chinchon returned to Spain in 1640, and his Countess, bringing with her a quantity of the healing bark, was thus the first person to introduce this invaluable medicine into Europe.[14] Hence it was sometimes called Countess's bark, and Countess's powder. Her physician, Juan de Vega, sold it at Seville for one hundred reals the pound. In memory of this great service Linnæus named the genus which yields it *Chinchona*, and afterwards the lady Ana's name was still further immortalized in the great family of *Chinchonaceæ*, which, together with *Chinchonæ*, includes ipecacuanhas and coffees. By modern writers the first *h* has usually been dropped, and the word is now almost invariably, but most erroneously, spelt *Cinchona*.

After the cure of the Countess of Chinchon, the Jesuits were the great promoters of the introduction of bark into Europe. In 1639, as the last act of his viceroyalty, her husband did good service to the cause of geographical discovery, by causing the expedition

under the Portuguese Texeira to proceed from Quito to the mouth of the Amazons, accompanied by the Jesuit Acuña, who wrote a most valuable account of the voyage.[15] From that time the missionaries of Acuña's fraternity continued to penetrate into the forests bordering on the upper waters of the Amazons, and to form settlements; and Humboldt mentions a tradition that these Jesuits accidentally discovered the bitterness of the bark, and tried an infusion of it in tertian ague. In 1670 the Jesuit missionaries sent parcels of the powdered bark to Rome, whence it was distributed to members of the fraternity throughout Europe by the Cardinal de Lugo, and used for the cure of agues with great success. Hence the name of "Jesuits' bark," and "Cardinal's bark;" and it was a ludicrous result of its patronage by the Jesuits that its use should have been for a long time opposed by Protestants and favoured by Roman Catholics. In 1679 Louis XIV. bought the secret of preparing quinquina from Sir Robert Talbor, an English doctor, for two thousand louis-d'ors, a large pension, and a title. From that time Peruvian bark seems to have been recognised as the most efficacious remedy for intermittent fevers. The second Lord Shaftesbury, who died in 1699, mentions in one of his letters—"Dr. Locke's and all our ingenious and able doctors' method of treating fevers with the Peruvian bark:" he declares his belief that it is "the most innocent and effectual of all medicines;" but he also alludes to "the bugbear the world makes of it, especially the tribe of inferior physicians."

There can be no doubt that a very strong prejudice was raised against it, which it took many years to conquer; and the controversies which arose on the subject between learned doctors were long and acrimonious. Dr. Colmenero, a professor of the University of Salamanca, wrote a work in which he declared that ninety sudden deaths had been caused by its use in Madrid alone.[16] Chiflet (Paris, 1653) and Plempius (Rome, 1656), two great enemies of novelty, prophesied the early death of quinquina, and its inevitable malediction by future ages; while the more enlightened Badius (Genoa, 1656) defended its use, and quoted more than twelve thousand cures by the aid of this remedy, performed by the best doctors of the hospitals in Italy. In 1692 Dr. Morton, one of the opponents of its use, was obliged to retract all he had said against quinquina; and it was then that it began to be generally admitted as a valuable medicine. It still, however, remained a subject of controversy, and as late as 1714 two Italian physicians, Ramazzini and Torti,[17] held opposite views on the subject. Ramazzini wrote against its use with much violence, while Torti maintained that, in proper doses, it would arrest remittent and intermittent fevers.[18]

Whilst the inestimable value of Peruvian bark was gradually forcing conviction on the most bigoted medical conservatives of Europe, and whilst the number and efficacy of cures effected by its means were bringing it into general use, and consequently increasing the demand, it was long before any knowledge was obtained of the tree from which it was taken. In 1726 La Fontaine, at the solicitation of the Duchess of Bouillon,

who had been cured of a dangerous fever by taking Peruvian bark, composed a poem in two cantos to celebrate its virtues; but the exquisite beauty of the leaves, and the delicious fragrance of the flowers of the quinquina-tree, with allusions to which he might have adorned his poem, were still unknown in Europe.

The first description of the quinquina-tree is due to that memorable French expedition to South America, to which all branches of science owe so much. The members of this expedition, MM. De la Condamine, Godin, Bouguer, and the botanist Joseph de Jussieu, sailed from Rochelle on the 16th of May, 1735, to measure the arc of a degree near Quito, and thus determine the shape of the earth. After a residence at Quito, Jussieu set out for Loxa, to examine the quinquina-tree, in March, 1739, and in 1743 La Condamine visited Loxa, and stayed for some time at Malacotas, with a Spaniard whose chief source of income was the collection of bark. He obtained some young plants with the intention of taking them down the river Amazons to Cayenne, and thence transporting them to the Jardin des Plantes at Paris; but a wave washed over his little vessel near Para, at the mouth of the great river, and carried off the box in which he had preserved these plants for more than eight months. "Thus," he says, "I lost them after all the care I had taken during a voyage of more than twelve hundred leagues."[19] This was the first attempt to transport chinchona-plants from their native forests.

Condamine described the quinquina-tree of Loxa in the 'Mémoires de l'Académie;'[20] he was the first man of science who examined and described this important plant; and in 1742 Linnæus established the genus CHINCHONA, in honour of the Countess Ana of Chinchon. He, however, only knew of two species, that of Loxa, which was named *C. officinalis*, and the *C. Caribæa*, since degraded to the medicinally worthless genus of *Exostemmas*.

Joseph de Jussieu, whose name is associated with that of La Condamine in the first examination of the chinchona-trees of Loxa, continued his researches in South America after the departure of his associate. He penetrated on foot into the province of Canelos, the scene of Gonzalo Pizarro's wonderful achievements and terrible sufferings; he visited Lima with M. Godin; he travelled over Upper Peru as far as the forests of Santa Cruz de la Sierra; and he was the first botanist who examined and sent home specimens of the coca-plant, the beloved narcotic of the Peruvian Indian. After fifteen years of laborious work he was robbed of his large collection of plants by a servant at Buenos Ayres, who believed that the boxes contained money. This loss had a disastrous effect on poor Jussieu, who, in 1771, returned to France, deprived of reason, after an absence of thirty-four years. Dr. Weddell has named the shrubby variety of *C. Calisaya* in honour of this unfortunate botanist *C. Josephiana*.

For many years the quinquina-tree of Loxa, the *C. officinalis* of Linnæus, was the only species with which botanists were acquainted; and from 1640 to 1776 no other bark was met with in commerce than that which was exported from the Peruvian port of

Payta, brought down from the forests in the neighbourhood of Loxa. The constant practice of improvidently felling the trees over so small an area for more than a century, without any cessation, inevitably led to their becoming very scarce, and threatened their eventual extinction. As early as 1735 Ulloa reported to the Spanish Government, that the habit of cutting down the trees in the forests of Loxa, and afterwards barking them, without taking the precaution of planting others in their places, would undoubtedly cause their complete extirpation. "Though the trees are numerous," he added, "yet they have an end;" and he suggested that the Corregidor of Loxa should be directed to appoint an overseer, whose duty it should be to examine the forests, and satisfy himself that a tree was planted in place of every one that was felled, on pain of a fine.[21] This wise rule was never enforced, and sixty years afterwards Humboldt reported that 25,000 trees were destroyed in one year.

The measures adopted by the Spanish Government towards the end of the last century, in sending botanical expeditions to explore the chinchona forests in other parts of their vast South American possessions, led to the discovery of additional valuable species, the introduction of their barks into commerce, and the reduction of the pressure on the Loxa forests, which were thus relieved from being the sole source whence Peruvian bark could be supplied to the world.

The region of chinchona-trees extends from 19° S. latitude, where Weddell found the *C. Australis*, to 10° N., following the almost semicircular curve of the cordillera of the Andes over 1740 miles of latitude. They flourish in a cool and equable temperature, on the slopes and in the valleys and ravines of the mountains, surrounded by the most majestic scenery, never descending below an elevation of 2500, and ascending as high as 9000 feet above the sea. Within these limits their usual companions are tree ferns, melastomaceæ, arborescent passion-flowers, and allied genera of chinchonaceous plants. Below them are the forests abounding in palms and bamboos, above their highest limits are a few lowly Alpine shrubs. But within this wide zone grow many species of chinchonæ, each within its own narrower belt as regards elevation above the sea, some yielding the inestimable bark, and others commercially worthless. And the species of chinchonæ, in their native forests, are not only divided from each other by zones as regards height above the sea, but also by parallels of latitude. In Bolivia and Caravaya, for instance, the valuable *C. Calisaya* abounds, but it is never found nearer the equator than 12° S. Between that parallel and 10° S. the forests are for the most part occupied by worthless species, while in Northern Peru the important grey barks of commerce are found. In each of these latitudinal regions the different species are again divided by belts of altitude. Yet this confinement within zones of latitude and altitude is not a constant rule; for several of the hardier and stronger species have a wider range; while the more sensitive, and these are usually the most precious kinds, are close prisoners within their allotted zones, and never pass more than a hundred yards beyond them. All

the species are, of course, affected by local circumstances, which more or less modify the positions of their zones, as regards altitude.

Thus, to give a geographical summary of the chinchona region, beginning from the south, it commences in the Bolivian province of Cochabamba in 19° S., passes through the yungus of La Paz, Larecaja, Caupolican, and Munecas, into the Peruvian province of Caravaya; thence through the Peruvian forests, on the eastern slopes of the Andes, of Marcapata, Paucartambo, Santa Anna, Guanta, and Uchubamba, to Huanuco and Huamalies, where the grey bark is found. It then continues through Jaen, to the forests near Loxa and Cuenca, and on the western slopes of Chimborazo. It begins again in latitude 1° 51′ N. at Almaguer, passes through the province of Popayan, and along the slopes of the Andes of Quindiu, until it reaches its extreme northern limit on the wooded heights of Merida and Santa Martha.

Humboldt remarks that, beyond these limits, the Silla de Caraccas, and other mountains in the province of Cumana, possess a suitable altitude and climate for the growth of chinchona-trees, as well as some parts of Mexico, yet that they have never been found either in Cumana or Mexico; and he suggests that this may be accounted for by the breaks which take place in Venezuela on the one hand, and on the isthmus of Panama on the other, where tracts of country of low elevation intervene between the lofty mountains of Cumana and Mexico and the chinchona region of the main Andes. In these low districts the chinchona-trees may have encountered obstacles which prevented their propagation to the northward: otherwise we might expect to find them in the beautiful Mexican woods of Jalapa, whither the soil and climate, and their usual companions the tree ferns and melastomaceæ, would seem to invite them.[22]

Be this how it may, the chinchona-plant has never been found in any part of the world beyond the limits already described.

The chinchonas, when in good soil and under other favourable circumstances, become large forest trees; on higher elevations, and when crowded, and growing in rocky ground, they frequently run up to great heights without a branch; and at the upper limit of their zone they become mere shrubs. The leaves are of a great variety of shapes and sizes, but, in most of the finest species, they are lanceolate, with a shining surface of bright green, traversed by crimson veins, and petioles of the same colour. The flowers are very small, but hang in clustering panicles, like lilacs, generally of a deep roseate colour, paler near the stalk, dark crimson within the tube, with white curly hairs bordering the laciniæ of the corolla. The flowers of *C. micrantha* are entirely white. They send forth a delicious fragrance which scents the air in their vicinity.

The earliest botanists gave the name of Chinchona to a vast number of allied genera, which have since been separated, and grouped under other names.[23] There are three characteristics by which a true chinchona may invariably be known; the presence of

curly hairs bordering the laciniæ of the corolla, the peculiar mode of dehiscence of the capsule from below upwards, and the little pits at the axils of the veins on the under sides of the leaves. These characters distinguish the chinchona from many trees which grow with it, and which might at first sight be taken for the same genus. The fact, established by the investigations of chemists, that none of these allied genera contain any of the medicinal alkaloids, has confirmed the propriety of their expulsion from the chinchona genus by botanists; and Dr. Weddell gives a list of seventy-three plants, once received as Chinchonæ, which are now more properly classed under allied genera, such as *Cosmibuena*, *Cascarilla*, *Exostemma*, *Remijia*, *Ladenbergia*, *Lasionema*, &c.[24]

Thus thinned out and reduced in numbers, the list of species of Chinchonæ has been established by Dr. Weddell at nineteen, and two doubtful;[25] but even the classification of this eminent authority, published in 1849, already requires much alteration and revision. For instance: Dr. Weddell gives no place to the "red-bark" species, the richest in alkaloids, and one of the most important, which, through the recent investigations of Mr. Spruce, will now probably be admitted by botanists as a distinct species, the *C. succirubra* (Pavon). A new grey bark now introduced into India as *C. Peruviana* (Howard), and the *C. Pahudiana* (Howard), a worthless kind, cultivated by the Dutch in Java, will also be received as additional species. It seems likely also that the *C. Condaminea* requires to be divided into two or three distinct species; while the *C. Boliviana* (Weddell) will sink into a mere variety of the *C. Calisaya*.

The commercially valuable species, however, comprise but a small proportion of the whole; and, as all these have now been introduced into India, they alone deserve our attention. They are as follows:—

	C. succirubra ..	(Pavon)	..	yielding *Red bark.*
C. Condaminea.	*C. Chahuarguera*	(Pavon)	..	„ *Crown bark.*
	C. crispa	(Tafalla)		
	C. Uritusinga ..	(Pavon)		
	C. lancifolia ..	(Mutis)	..	„ *Carthagena bark.*
	C. nitida	(Ruiz & Pavon)	..	„ *Grey bark.*
	C. micrantha ..	(Ruiz & Pavon)		
	C. Peruviana ..	(Howard)		
	C. Calisaya ..	(Weddell)	..	„ *Yellow bark.*

These species yield five different kinds of medicinal barks, which are collected from five different regions in South America; and in the following chapter I propose to give a brief account of each of these regions, of their chinchona-trees, and of the investigations of botanists down to the time when measures were taken to introduce these inestimable plants into Java and India. Such an account will naturally divide itself into five sections:—

I. —The Loxa region, and its *crown barks*.
II. —The *red-bark* region, on the western slopes of Chimborazo.

III. —The New Granada region.
IV. —The Huanuco region in Northern Peru, and its *grey barks*.
V. —The *Calisaya* region, in Bolivia and Southern Peru.

Before entering on this subject, however, it will be well to cast a hasty glance at the progress of those investigations which ended in the discovery of the febrifugal principle in Peruvian bark.

The roots, flowers, and capsules of the chinchona-trees have a bitter taste with tonic properties, but the upper bark is the only part which has any commercial value.[26] The bark of trees is composed of four layers—the epiderm, the periderm, the cellular layer, and the liber or fibrous layer, composed of hexagonal cells filled with resinous matter and woody tissue. In growing, the tree pushes out the bark, and, as the exterior part ceases to grow, it separates into layers, and forms the dead part or periderm; which in chinchonas is partially destroyed, and blended with the thallus of lichens. The bark is thus formed of the dead part, or periderm, and the living part, or derm. On young branches there is no dead part, the exterior layers remaining entire, while the inner layers have not had time to develop. In thick old branches, on the contrary, the periderm or dead part is considerable, while the fibrous layer of the derm is fully developed. In preparing the bark the periderm is removed by striking the trunk with a mallet, and the derm is then taken off by uniform incisions. The thin pieces from small branches are simply exposed to the sun's rays, and assume the form of hollow cylinders, or quills, called by the natives *canuto* bark. The solid trunk bark is called *tabla* or *plancha*, and is sewn up in coarse canvas and an outer envelope of fresh hide, forming the packages called *serons*.

The character of the transverse fracture affords an important criterion of the quality of the bark. Cellular tissue breaks with a short and smooth fracture, woody tissue with a fibrous fracture, as is the case with the *calisaya* bark. The best characteristics by which barks containing much quinine may be distinguished are the shortness of the fibres which cover the transverse fracture, and the facility with which they may be detached, instead of being flexible and adhering as in bad barks. Thus, when dry *calisaya* bark is handled, a quantity of little prickles run into the skin, and this forms one of its distinguishing marks.[27]

Until the present century Peruvian bark was used in its crude state, and numerous attempts were made at different times to discover the actual healing principle in the bark, before success was finally attained. The first trial which is worthy of attention was made in 1779 by the chemists Buguet and Cornette, who recognised the existence of an essential salt, a resinous and an earthy matter in quinquina bark. In 1790 Fourcroy discovered the existence of a colouring matter, afterwards called *chinchona red*, and a Swedish doctor named Westring, in 1800, believed that he had discovered the active

principle in quinquina bark. In 1802 the French chemist Armand Seguin undertook the bark trade on a large scale, and found it necessary to study the means of discovering good barks, and distinguishing them from bad ones. He found that the best quinquina bark was precipitated by tannin, while the bad was not precipitated by that substance. In 1803 another chemist found a crystalline substance in the bark which he called "*sel essentiel fébrifuge*" but it was nothing more than the combination of lime with an acid which was named *quinic acid*. Reuss, a Russian chemist, in 1815, was the first to give a tolerable analysis of quinquina bark; and about the same time Dr. Duncan of Edinburgh suggested that a real substance existed as a febrifugal principle. Dr. Gomez, a surgeon in the Portuguese navy, in 1816, was the first to isolate this febrifugal principle hinted at by Dr. Duncan, and he called it *chinchonine*.[28]

But the final discovery of quinine is due to the French chemists Pelletier and Caventou, in 1820. They considered that a vegetable alkaloid, analogous to morphine and strychnine, existed in quinquina bark; and they afterwards discovered that the febrifugal principle was seated in two alkaloids, separate or together, in the different kinds of bark, called *quinine* and *chinchonine*, with the same virtues, which, however, were much more powerful in quinine. It was believed that in most barks chinchonine exists in the cellular layer, and quinine in the liber, or fibrous layer; but Mr. Howard has since shown that this view is quite incorrect.[29] In 1829 Pelletier discovered a third alkaloid, which he called *aricine*, of no use in medicine, and derived from a worthless species of chinchona, growing in most of the forests of Peru, called *C. pubescens*.[30]

The organic constituents of chinchona barks are—

Quina.	Kinovic acid.
Chinchonia.	Chinchona red.
Aricina.	A yellow colouring matter.
Quinidia.	A green fatty matter.
Chinchonidia.	Starch.
Quinic acid.	Gum.
Tannic acid.	Lignin.

These materials are in different proportions according to the barks. Grey bark chiefly contains chinchonine and tannin; Calisaya, or yellow bark, much quinine, and a little chinchonine; red bark holds quinine and chinchonine in nearly equal proportions; while the barks of New Granada chiefly contain chinchonidine and quinidine. The two latter alkaloids were definitively discovered in 1852 by M. Pasteur; although the Dutch chemist Heijningen had, in 1848, found what he called β quinine or quinidine. Chinchonidine is only second to quinine itself in importance as a febrifugal principle.

Quinine is a white substance, without smell, bitter, fusible, crystallized, with the property of left-handed rotatory polarization. The salts of quinine are soluble in water, alcohol, and ether. Of all the salts the bisulphate of quinine is preferred, because it constitutes a stable salt, easy to prepare, and containing a strong proportion of the alkaloid. It is very bitter and soluble, and crystallizes in long silky needles. It is prepared by adding sulphuric acid to the sulphate.[31]

Chinchonine differs from quinine in being less soluble in water, and being altogether insoluble in ether. It has the property of right-handed rotatory polarization.

Quinidine also has the property of right-handed rotatory polarization, and forms salts like those of quinine. It becomes green by successive additions of chlorine and ammonia.

Chinchonidine has not the property of turning green, and forms a sulphate almost exactly like sulphate of quinine.[32]

The discovery of these alkaloids in the quinquina[33] bark, by enabling chemists to extract the healing principle, has greatly increased the usefulness of the drug. In small doses they promote the appetite and assist digestion; and chinchonine is equal to quinine in mild cases of intermittent fever; but in severe cases the use of quinine is absolutely necessary. Thus these alkaloids not only possess tonic properties to which recourse may be had under a multitude of circumstances, but also have a febrifugal virtue which is unequalled, and which has rendered them almost a necessary of life in tropical countries, and in low marshy situations where agues prevail. Many a poor fellow's life was saved in the Walcheren expedition by the timely arrival of a Yankee trader with some chests of bark, after the supply had entirely failed in the camp.[34] Dr. Baikie, in his voyage up the Niger, attributed the return of his men alive to the habitual use of quinine; and the number of men whose lives it has saved in our naval service and in India will give a notion of the vast importance of a sufficient and cheap supply of the precious bark which yields it. India and other countries have been vainly searched for a substitute for quinine, and we may say with as much truth now as Laubert did in 1820 —"This medicine, the most precious of all those known in the art of healing, is one of the greatest conquests made by man over the vegetable kingdom. The treasures which Peru yields, and which the Spaniards sought and dug out of the bowels of the earth, are not to be compared for utility with the bark of the quinquina-tree, which they for a long time ignored.[35]

CHAPTER II.

The valuable species of Chinchona-trees—their history, their discoverers, and their forests.

I.—THE LOXA REGION, AND ITS *CROWN BARKS*.

THE region around Loxa, on the southern frontier of the modern republic of Ecuador, is the original home of the Chinchona, and nearly in the centre of its latitudinal range of growth. On the lofty grass-covered slopes of the Andes, around the little town of Loxa, and in the sheltered ravines and dense forests, those precious trees were found which first made known to the world the healing virtues of Peruvian bark. They were most plentifully met with in the forests of Uritusinga, Rumisitana, Cajanuma, Boqueron, Villonaco, and Monje, all within short distances of Loxa.

Linnæus had named these trees *Chinchona officinalis*; but when Humboldt and Bonpland examined them, the discovery of other species yielding medicinal bark had rendered the name inappropriate, and they very properly re-christened them, after the distinguished Frenchman who had originally described them, *Chinchona Condaminea*. Humboldt says that they grow on mica slate and gneiss, from 6000 to 8000 feet above the sea, with a mean temperature between 60° and 65° Fahr. In his time the tree was cut down in its first flowering season, or in the fourth or seventh of its age, according as it had sprung from a vigorous root-shoot, or from a seed. He describes the luxuriance of the vegetation to be such that the younger trees, only six inches in diameter, often attain from fifty-three to sixty-four English feet in height. "This beautiful tree," he continues, "which is adorned with leaves above five inches long and two broad, growing in dense forests, seems always to aspire to rise above its neighbours. As its upper branches wave to and fro in the wind, their red and shining foliage produces a strange and peculiar effect, recognisable from a great distance."[36] It varies much in the shape of the leaves, according to the altitude at which it grows, and bark-collectors themselves would be deceived if they did not know the tree by the glands, so long unobserved by botanists. The *C. Condaminea* described by Humboldt is the same as the *C. Uritusinga* of Pavon. It once yielded great quantities of thick trunk bark, but, owing to reckless felling through a course of years, it is now almost exterminated, and its bark is rarely met with in commerce. The distinguished botanist Don Francisco Caldas examined the chinchona forests of Loxa after Humboldt, between 1803 and 1809. He says that the famous quina-tree of Loxa grows in the forests of Uritusinga and Cajanuma, at a height of from 6200 to 8200 feet above the sea, in a temperature of 41° to 72° Fahr.; but that it is only found between the rivers Zamora and Cachiyacu.[37] He describes the tree as from thirty to forty-eight feet high, with three or more stems growing from the same root;

the leaves as lanceolate, shining on both sides, with veins a rosy colour, a short and tender pubescence on the under side when young, and when past maturity a bright scarlet colour; the bark black when exposed to the sun and wind, a brownish colour when closed in by other trees, and always covered with lichens;[38] and the rock on which the trees grow, a micaceous schist.

Don Francisco José de Caldas, a native of New Granada, was one of the most eminent scientific men that South America has yet produced. He was associated with Mutis in the botanical expedition of New Granada; he explored the chinchona region as far as Loxa; and thus takes his place as one of those to whom we are indebted for throwing light on the nature of the trees yielding Peruvian bark. Caldas was born at Popayan in the year 1770; and, from early youth, devoted himself to the pursuits of science with untiring energy, especially studying botany, mathematics, meteorology, and physical geography. He constructed his own barometer and sextant, and, ignorant of the methods adopted in Europe, he discovered the way of ascertaining altitudes by a boiling-point thermometer. He has left many memoirs on botanical and other subjects behind him, and his style is always animated, clear, and interesting; but many of the productions of this remarkable man are still in manuscript,[39] and others are lost to us for ever. Above all, it is to be regretted that his botanical chart of the chinchona genus, which he promised in one of his memoirs, has never seen the light. After the declaration of independence Caldas was nominated by the Congress at Bogota to publish the works of his friend the botanist Mutis. When the brutal Spanish General Morillo entered Bogota in June 1816, he perpetrated a series of savage massacres, in which more than 600 of the most distinguished men in the country fell victims. Among them was Caldas, who was shot through the back on the 30th of October 1816.[40]

The Spanish botanists Ruiz and Pavon also examined the chinchona-trees of Loxa; and the latter described two species, *C. Uritusinga*, named from the mountain on which it was once most abundant, and *C. Chahuarguera*, so called from a fancied resemblance of the bark to a pair of breeches (*huara* in Quichua) made from the fibre of the American aloe (*chahuar*). To these the botanist Tafalla added the *C. crispa*. These three species are all included in Humboldt's *C. Condaminea*, which is readily known by the little pits, bordered with hairs, at the axils of the veins on the under side of the leaf. It would appear that at one period of growth these little pits or scrobicules are wanting, but when the plant is in full vigour they are markedly prominent. The *C. Chahuarguera*[41] is described by Pavon as growing from eighteen to twenty-four feet in height; although now the trees, which yield the Loxa bark of commerce, do not attain a height of more than four to nine feet. It is met with on the grassy open crests of mountain ridges, in light sandy soil interspersed with rocks, amongst shrubs and young plants. The barks of Loxa were called *crown barks*, because they were reserved for the exclusive use of the royal pharmacy at Madrid; and they originally sold at Panama for five and six

dollars, and at Seville for twelve dollars the pound; but in later times they were much adulterated, and the price fell to one dollar the pound.

The *C. Chahuarguera* is the *rusty crown bark* of commerce,[42] and the *C. crispa* is the *quina fina de Loxa* or *crespilla negra* of the natives. A parcel of it has quite recently sold at a higher price than *Calisaya* quills. With this *rusty crown bark* are mixed larger quills particularly rich in the alkaloid called chinchonidine.[43] The *C. Uritusinga* grew to the height of a lofty forest tree, but it is now nearly exterminated. The leaves assume a red colour before they fall, acquiring the most beautiful tints, and the tree is one of the finest in those forests.[44] It is said that there is a great difference in the bark, according as it is grown on the sides of mountains most exposed to the morning or evening sun; and its position is believed to have a great influence on the quality of its alkaloids. The usual yield of the large quills is 3.5 to 3.6 per cent.[45]

The bark-collectors of Loxa are said to show some little forethought, a quality which is entirely wanting in most of their fraternity. To save the trees they occasionally cut off the whole of the bark, with the exception of one long strip, which gradually replaces its loss; and the second cutting is called *cascarilla resecada*. This practice was in use in the days of the botanist Ruiz, who protested against it, and declared that it was very injurious to the trees, many having been destroyed by it.[46] Later accounts, however, show that the bark-collectors of Loxa are as thoughtlessly destructive as those in other parts of South America. They often pull up the roots, while the annual burning of the slopes, and the continual cropping of the young shoots by cattle, assist the work of destruction.[47]

It is, therefore, well that the *C. Chahuarguera* and *C. Uritusinga*, the earliest known and among the most valuable of the chinchona-trees, should have been saved from extinction by timely introduction into India.

The annual export of Loxa bark, from the port of Payta, is from 800 to 1000 cwts.

II.—THE "RED-BARK" REGION, ON THE WESTERN SLOPES OF CHIMBORAZO.

The species yielding "red bark," the richest and most important of all the Chinchonæ, is found in the forests on the western slopes of Mount Chimborazo, along the banks of the rivers Chanchan, Chasuan, San Antonio, and their tributaries. So early as 1738 Condamine spoke of "red bark" (*cascarilla colorada*) as being of superior quality;[48] and Pavon sent home specimens of the "red bark of Huaranda," and named the species *C. succirubra*. Some of these are now in the British Museum; and in the collection of Ruiz and Pavon, in the botanical gardens at Madrid, I found capsules, flowers, and leaves marked "*cascarilla colorada de los cerros de San Antonio*." In 1857 Dr.

Klotzsch, an eminent German botanist, read a paper at Berlin,[49] elaborately describing the "red bark" as a product of *C. succirubra*, from a very good specimen of Pavon's in the Berlin Museum. Mr. Howard has also received a specimen from Alausi, and he is inclined to the belief that there are several varieties of *C. succirubra*, and one or two allied species, as yet undescribed.[50] Much light was thrown upon the history of this valuable species by Mr. Spruce, when he penetrated into the forests to collect seeds and plants for transmission to India in 1860.

Though little was known of the tree until quite lately, there was never any doubt concerning the value of the bark. In 1779 a Spanish ship from Lima, bound to Cadiz, was captured off Lisbon by the 'Hussar' frigate, and her cargo consisted chiefly of "red bark," part of which was imported into England. In 1785 and 1786 Ruiz states that the collectors began to gather the bark of *C. succirubra*, and sell it at Guayaquil, and from that time it continued to be found in the European markets. It contains a larger proportion of alkaloids than any other kind, amounting to as much as from 3 to 4 per cent. of the substance of the bark, and of this a fair share is quinine. Fine samples yield 3.9 per cent., selling at 8*s.* 9*d.* per lb.; and the quill bark from the smaller branches 3.6 per cent.[51] Mr. Howard has recently procured 8.5 per cent. of alkaloids from a specimen of "red bark." A large supply of plants of this species is flourishing in India and Ceylon, and, from the richness of the species, the comparatively low elevation at which it thrives, and its hardy nature, it may be expected to become a cultivated plant of great value and importance.

In 1857 the export of bark from the port of Guayaquil, the place of shipment for the *C. succirubra*, amounted to 7006 quintals, valued at 23,353*l.*[52] In 1849-50 Dr. Weddell gives the amount at 1042 quintals.

III.—THE NEW-GRANADA REGION.

The importance of the chinchona-trees was fully established in the middle of the last century, and, Don Miguel de Santistevan, the director of the mint at Bogota, having addressed a memorial on the bark trade (*estanco de cascarilla*) to the Viceroy Marquis of Villar in 1753, the attention of the Spanish Government was seriously turned to the subject. When the Viceroy Don Pedro Mesia de la Cerda, Marquis de la Vega de Armijo, went out to Bogota in 1760,[53] he was accompanied by the botanist Don José Celestino Mutis, a native of Cadiz, who was appointed to conduct a botanical survey of New Granada, and especially to investigate the bark of the chinchona-trees.[54]

In 1772 Mutis found these trees in the neighbourhood of Bogota, and described four kinds in 1792, which he called *C. lancifolia*, *C. cordifolia*, *C. oblongifolia*, and *C. ovalifolia*, yielding four kinds of barks—*anaranjada*, *amarilla*, *roja*, and *blanca*, or

orange-coloured, yellow, red, and white.[55] He declared the *C. lancifolia* to be excellent for intermittent fevers, in which he was right, and to be identical with the *C. Condaminea* of Loxa, in which he was wrong; the *C. cordifolia* he recommended for remittent fevers, and the other two for inflammatory diseases. In reality the two last are not chinchonas at all, but belong to the genus *Ladenbergia*, and contain no fever-dispelling alkaloids whatever; while the *C. Cordifolia* is so poor in alkaloids as to be practically worthless.

While Mutis, and his disciples Caldas and Zea, were prosecuting their researches in New Granada, an expedition under the botanists Ruiz and Pavon was sent to Peru; and an acrimonious paper war sprang up between the rivals, as to the respective merits of the barks of New Granada and Peru. Ruiz declared the New Granada kinds to be inferior to those of Peru, while Mutis contradicted him, and Zea[56] went so far as to maintain that the species found by Ruiz and Pavon in Peru were mere varieties of the four chinchonas of Mutis, growing near Bogota.[57]

The *C. lancifolia* of Mutis is dispersed in wild inaccessible forests, while the other three kinds grow in partly cultivated and inhabited regions, and their barks are therefore much more easy to collect. These worthless barks were, therefore, largely exported from Carthagena and Santa Martha, while the valuable *C. lancifolia* was neglected; and the consequence was that the barks of New Granada fell entirely into discredit for many years. In about 1849, however, Dr. Santa Maria of Bogota discovered the *C. lancifolia* afresh, producing the *quina anaranjada*, and it has recently been found in the whole cordillera from Bogota to Popayan, and largely exported between 1849 and 1855, when the supplies began to fail.

Dr. Karsten, a distinguished German botanist, has lately returned from a residence of some years in New Granada, where he thoroughly examined the region of *C. lancifolia*. His remarks on the production of alkaloids in chinchona barks are very important. He came to the conclusion that the content of alkaloids was not always the same in the same species of chinchona, and that the soil and relations of climate, on which the nourishment of the plant depends, exercise considerable influence. He also assumes, what is undoubtedly true, that the chinchonæ with the capsule opening from the base and crowned by the calyx, with a corolla of delicate texture and bearded edges, and generally unindented seed-lobes, give febrifugal barks; but his further position that the short oval or elliptic capsules are a sign of a regularly larger content of alkaloids, while long capsules show a small quantity or total absence of quinine and chinchonine, though doubtless correct so far as Dr. Karsten's personal observation extended, will not bear general application. The *C. succirubra*, the richest of all the barks in alkaloids, would certainly come under the latter head. Dr. Karsten's observations on the differences in the structure of the false and true barks are also exceedingly valuable.

The *C. lancifolia* of New Granada has been found to contain as much as 2½ per cent. of quinine and from 1 to 2 per cent. of chinchonine. The trees are found in forest-regions veiled in fog and rain, and often exposed to frost, where the temperature ranges from freezing-point to 77° Fahr., at heights of 7000 feet and upwards above the level of the sea. They attain a height of 80 feet and 5 feet in diameter, but the average size is 30 or 40 feet high and 3 feet in girth.[58] Seeds of this species, collected by Dr. Karsten, were sent to Java, and there are now several plants raised from these seeds in India.[59]

I find that between 1802 and 1807 the export of New Granada bark from the port of Carthagena was 3,340,000 lbs.; the largest quantity in one year being 48,330 lbs. in 1806. The first arrivals in Spain sold at 5 to 6 dollars a pound, but in 1808 they were worth next to nothing, owing to the damaged state in which the bark arrived.[60]

IV.—THE HUANUCO REGION IN NORTHERN PERU, AND ITS GREY BARKS.

The chinchona-trees, in the forests of the province of Huanuco, in Northern Peru, were discovered by Don Francisco Renquifo in 1776, on the mountain of San Cristoval de Cuchero or Cocheros; and Don Manuel Alcarraz brought the first sample of bark from Huanuco to Lima.

At almost the same time the Spanish government was organizing a botanical expedition to explore the chinchona forests of Peru; composed of the botanists Don José Pavon, Don Hipolito Ruiz, the Frenchman Dombey, and two artists named Brunete and Galvez. They embarked at Cadiz on November 4th, 1777, and reached Callao April 8th, 1778. Having made a large collection of plants in the neighbourhood of Lima, and despatched them to Spain,[61] they crossed the Andes, explored the forests of Tarma, and then proceeded to Huanuco. They traversed the valley of Chinchao, explored the hill of Cuchero or Cocheros, near Huanuco, and discovered seven species of chinchona-trees, [62] returning to Lima laden with the precious spoils of their expedition. They then sailed for Chile, and, after exploring the greater part of that province, they returned to Lima, and sent off their botanical collections in fifty-three boxes, which were all lost in the shipwreck of the 'San Pedro de Alcantara,' off the coast of Portugal, in 1786. M. Dombey returned to Europe at about the same time.

Ruiz and Pavon then returned to Huanuco, explored the courses of the rivers Pozuzu and Huancabamba, and eventually established themselves at the farm of Macora, near Huanuco, where they resided for two months with Don Francisco Pulgar and Don Juan Tafalla, who, by order of the king, had joined them as pupils and associates in their labours—the first as an artist, the second as a botanist. In August, 1785, a fire broke out in their house, which destroyed all their journals and collections; and they then undertook journeys through the forests of Muña, Pillao, and Chacahuasi, examining new

species of chinchonæ.[63] On April 1st, 1788, taking leave of Pulgar and Tafalla, they sailed from Callao, and reached Cadiz in September, when they commenced the publication of their great work the 'Flora Peruviana.'[64]

Tafalla continued his researches in the province of Huanuco, and discovered the *C. micrantha* in 1797, in the cool and shady forests of Monzon and Chicoplaya. Pavon calls him "noster alumnus."

The expeditions and discoveries of the Spanish botanists induced the merchants of Lima to speculate in bark, and brought the grey barks of Huanuco into the European markets.[65] In 1785 Don Juan de Bezares, a Lima merchant, devoted 2000 dollars to the exploration of the forests of Huamalies. He penetrated along the banks of the Monzon to Chicoplaya, passing mountains thickly covered with chinchona-trees, and engaged people to collect bark. Thousands of arrobas were thus obtained of the bark of *C. glandulifera*; and having been appointed Governor of Huamalies by the Viceroy Don Teodoro de Croix in 1788, Bezares commenced the construction of a good road down the valley of the Monzon.[66] Up to 1826 the principal supplies of grey bark were derived from *C. nitida*, but since that time they are believed to have come chiefly from *C. micrantha*.

Science owes much to the labours of Spanish botanists: the Spanish nation has every reason to be proud of her sons who explored the forests of the Andes with such untiring energy and distinguished ability; and the names of Mutis, Ruiz, Pavon, and Tafalla occupy no unimportant place in the history of botanical research. Nor, in this respect, have the natives of South America been behindhand. Caldas and Zea were worthy successors of Mutis; Franco Davila[67] represents the botanical learning of Peru; while in more modern times the name of the South American Triana is not unworthy to stand side by side with those of the best botanists in Europe.

CHINCHONA MICRANTHA.
(From Howard's 'Nueva Quinologia de Pavon.') **Page 32.**

After the days of Ruiz and Pavon, our chief authority on the grey barks of Huanuco is Dr. Poeppig, now a professor in Leipsic, who travelled in Chile and Peru between the years 1827 and 1832.[68] He says that, as in New Granada, the grey barks of Huanuco soon fell into discredit in the European markets, owing to the adulterations of small speculators, and that after 1815 the trade almost entirely ceased.[69] In 1830 scarcely 1250 lbs. of bark found their way from Huanuco to Lima.

In the flourishing times of the Huanuco bark trade the *cascarilleros*, or bark-collectors, entered the forests in parties of ten or more, with supplies of food and tools. They penetrated for several days into the virgin forest until they came to the region of the chinchona-trees, when they built some rude huts and commenced their work. The *cateador*, or searcher, then climbed a high tree, and, with the aid of experience and

sharp sight, soon discovered the *manchas* or clumps by their dark colour, and the peculiar reflection of the light from their leaves, easily observable even in the midst of these endless expanses of forest. The *cateador*, then, with never-erring instinct, conducted the party for hours through the tangled brushwood, to the chinchona clump, using the wood-knife at every step. From a single clump they often obtained a thousand pounds of bark, which was sent up to be dried beyond the limits of the forest. All depended on the success of this operation, for the bark easily becomes mouldy and loses its colour. The *cascarilleros* got two rials for every twenty-five pounds of green bark stripped, from the speculator, and, as they could easily strip three hundred pounds, they made two dollars a day. The bark cost the speculator about four dollars, and the price at Lima was sixteen to twenty dollars the arroba of twenty-five pounds.[70]

Dr. Poeppig makes some important remarks on the supposed danger of the total extirpation of the chinchona-trees by reckless felling. Condamine and Ulloa believed that this would be the case in the Loxa forests, and Poeppig thinks that their apprehensions were well founded, because there the trees are not felled, but left standing deprived of their bark, in which case they are attacked by rot with extraordinary rapidity in tropical forests, hosts of insects penetrate to the stem, and the healthy roots become infected. But it is only necessary to observe the precaution of hewing the stem as near as possible to the root, in order to be sure of its after-growth. After six years, near Cuchero, the young stems may already be felled again; but, at higher altitudes, where the most effective chinchonas are found, it requires twenty years. [71]

The *C. micrantha* abounds in the province of Huanuco, and the bark is known as *Cascarilla provinciana*. It yields 2.7 per cent. of chinchonine, and is much sought after for the Russian market.

The *C. nitida* is a lofty tree growing in the higher regions of Huanuco, and is known by the natives as *quina cana legitima* (genuine grey bark). It grows at a greater height than the former species, and yields 2.2 per cent. of chinchonine.

The *C. Peruviana*, so named by Mr. Howard, is the *Cascarilla de pata de gallinazo* of the natives. It grows in the forests at a lower elevation than *C. nitida*, and yields 3 per cent. of chinchonine and chinchonidine, consequently indicating a considerable amount of febrifugal power. Quinine has also been found in samples of grey bark.[72]

The name of *grey* bark refers to the striking effect of the overspreading thallus of various *Graphideæ*, forming groups, and indicating that the tree has grown in an open situation, exposed to rain and sunshine. A large supply of all the best kinds of grey bark is now growing in India.[73]

V.—THE CALISAYA REGION IN BOLIVIA AND SOUTHERN PERU.

The chinchona region of Bolivia and Southern Peru, although one of the most important, was the last to contribute supplies of bark to the European markets. The trees first became known through the investigations of the German botanist Thaddæus Haenke, and a Spanish naval officer named Rubin de Celis, who drew the attention of the inhabitants to the valuable forests on the eastern slopes of the Bolivian Andes in 1776, though the unfortunate French naturalist Joseph de Jussieu had previously explored some portions of those forests.[74] But it was not until 1820, when quinine was first discovered as the febrifugal principle of bark, that the *Chinchona Calisaya*[75] was recognised as containing more of that alkaloid than any other species.

After 1820 the demand for *calisaya* bark increased enormously; great numbers of *cascarilleros*, or bark-collectors, entered the forests, and in a short time scarcely a tree remained in the vicinity of the inhabited places; and the bark was exported in such quantities that the price fell very much.[76] It was not, however, until 1830 that the Bolivian Government interfered in the bark trade. It was then considered necessary by General Santa Cruz's administration to check the drain of this precious source of wealth by limiting the quantity of bark to be cut or exported; and in November, 1834, the Bolivian Congress decreed a law on the subject, which, however, never took effect. Finally, the cutting was prohibited for five years, but before the expiration of that period the decree was abrogated, and an export duty of twelve dollars to twenty dollars the quintal, or cwt., was imposed.

In 1844 the Bolivian Congress authorized the President, General Ballivian, to negotiate for the establishment of a national bank of bark, with the requisite capital, to export all the quinquina bark produced in the country. This Bolivian legislation on the chinchona bark, which is considered, with justice, the most important product of their country, is very curious, and sufficiently demonstrates the futility of attempting a system of protection and monopoly. Instead of taking measures to prevent the reckless destruction of the trees, to establish extensive nurseries for young plants, and thus ensure a constant and sufficient supply of bark, these Bolivians have meddled with the trade, attempted to regulate European prices by the most barbarous legislation, and allowed the forests to be denuded of chinchona-trees. In 1845 the bark monopoly was given to Messrs. Jorge Tesanos Pinto and Co., for five years, for the sum of 119,000 dollars, during which time not more than 4000 quintals of bark were to be exported annually. This company gave such iniquitously low prices to the *cascarilleros* for their bark, that a clamour was raised against it, and the President, General Belzu, put an end to its existence in March 1849.

Free trade, with a duty of twenty dollars the quintal, was then established during one year; but in 1850 exclusive privileges were again granted to Messrs. Aramayo Brothers and Co., who were to pay the Government 142,000 dollars a year for the right of

exporting 7000 quintals of bark annually, to be purchased of the *cascarilleros*, the *tabla* or trunk bark at sixty dollars the quintal, and the *canuto* or quill bark at thirty to thirty-six dollars the quintal. The Pinto company had only paid eighteen to twenty-two dollars the quintal for *tabla*, and eight to ten dollars for *canuto* bark. The favourable conditions thus offered to *cascarilleros* induced so great a number of persons to undertake the business, that at the end of the first year more than 20,000 quintals of bark arrived at La Paz—that is to say, more than twice as much as the company had agreed for, and more than the Pinto company had exported in five years. The Government then issued a decree to prevent the smuggling of bark, and another that no bark should be cut except for the company: but these measures caused much discontent, and in 1851 the Congress voted that the Executive had exceeded its powers in making these arrangements with the Aramayo company, and declared them to be null and void. The Aramayo company purchased 14,000 quintals of the bark, and agreed to take the same quantity during the two following years, paying only a third of the price in ready money; but a new company, formed under the name of Pedro Blaye and Co., engaged to purchase all the bark that was for sale, both at La Paz and Cochabamba, for ready money. It was evident that one or the other of these companies must break, and finally that of Blaye fell. The Government then determined to export the bark which remained in store on its own account, paying the same price as had been agreed on by the company.

These two companies lasted for two years, during which time the Bolivian forests yielded 3,000,000 lbs. of bark. Such was the result of the high prices which followed the fall of the Pinto monopoly; but it was the rich contractors, and not the poor bark-collectors, who derived benefit from the change.[77]

In 1851 Government prohibited the cutting of bark entirely, from the 1st of January, 1852, to the 1st of January, 1854.[78] In 1858 a decree was issued to regulate the transition of the system of monopoly to that of free-trade in bark, which caused an improvement in the prices in European markets; and in November, 1859, Dr. Linares, then President of Bolivia, declared the right to cut bark in the forests to be free, and reduced the duty 25 per cent. on the current prices, to be fixed at the beginning of each year.[79] This is the law which now regulates the bark trade in Bolivia, and, after a course of short-sighted meddling legislation, extending over twenty years, in 1850 it still brought 142,000 dollars annually into the public treasury, being a fifteenth part of the whole revenue of the Republic.

For exportation the bark is wrapped in fresh bullock-hides, having been previously sewn up in thick cotton bags containing 155 lbs. each. These hide packages are called *serons*, a mule-load being 285 lbs., and the transport to the coast costing about ten dollars for each mule-load.

It is to the persevering energy and great talent of that distinguished French botanist Dr. Weddell that we owe our knowledge of the chinchona regions of Bolivia and Southern

Peru, and especially of the inestimable quinine-yielding species which he identified as the *C. Calisaya*. Dr. Weddell accompanied the scientific expedition of the Count de Castelnau, which was sent out by Louis Philippe to South America, and, after crossing the vast empire of Brazil, entered Bolivia by the country of the Chiquitos in August, 1845. It was Dr. Weddell's chief object to examine the chinchona region of this country, and his first step was to proceed to Tarija, to ascertain the extreme southern limit of the chinchona-trees, which he discovered in 19° S. lat. He named the species *C. Australis*. Dr. Weddell then commenced a thorough exploration of the Bolivian chinchona forests, making his way over the most difficult country, from Cochabamba, through Ayopaya, Enquisivi, and the *yungus*[80] of La Paz; where the species of chinchonæ continued to multiply under his eye. In Enquisivi he first met with and studied the *C. Calisaya*, which he named and described, collecting much information respecting the trade, and the methods of collecting bark. In 1847 he entered the province of Capaulican, descending the river Tipuani, where he was attacked by fever, and ascending the Mapiri. At Apollobamba, the centre of the most ancient bark-collecting district, he found that the surrounding forests were quite cleared of chinchona-trees, and that it was necessary to seek for them at a distance of ten or twelve days' journey from any inhabited place. In June 1847 Dr. Weddell entered the Peruvian province of Caravaya, examined the chinchona forests of the valleys of Sandia (San Juan del Oro) and Tambopata, and concluded his investigations by a visit to the lovely ravine of Santa Anna, near Cuzco.

Dr. Weddell was accompanied in his visit to the valleys of Santa Anna by M. Delondre, a manufacturer of quinine at Havre, who, after contemplating the project of paying a personal visit to the chinchona forests for twenty years, had at length set out, landed at Islay in July, 1847, and proceeded by way of Arequipa to Cuzco. M. Delondre appears to have employed a contractor to supply him with bark, who failed in his engagements, and of whom the French quinine manufacturer bitterly complains as a second Dousterswivel.[81] MM. Weddell and Delondre finally left the chinchona forests in September, 1847, and set out for the coast of Peru. Dr. Weddell's valuable monograph on the chinchona genus, '*Histoire naturelle des Quinquinas*,' the most important work that has yet appeared on the subject, was published at Paris in 1849.

In 1851 Dr. Weddell undertook a second voyage to South America, and in 1852 he entered the Bolivian chinchona region of Tipuani by way of Sorata. In descending the eastern slopes of the Andes he describes the vegetation as taking new forms at every mile of the descent. The undergrowth was formed of *Melastomaceæ* with violet-coloured flowers (*Chætogastra*), myrtles, *Gaultherias*, and *Andromedas*; lower down there were many superb species of *Thibaudias*; and, where the great forests succeed to the smaller growth of the more elevated region, the predominant trees were *Escallonias*, arborescent *Eupatorias*, *Bocconias*, and a fruit-bearing *Papilionacea* with a scarlet corolla. He encountered the first forest chinchona-trees at an elevation of 7138 feet, being the *C. ovata var. α vulgaris*. Descending still, he came to paccay-trees

(*Mimosa Inga*) in flower, and met with the first plant of the shrubby variety of *C. Calisaya*, on an open grassy ridge or *pajonal*, at an elevation of 4800 feet.

Dr. Weddell descended the river Tipuani to Guanay, a mission of Lecos Indians, and ascended the Coroico in a canoe made of the wood of a species of *Bombax*. The forests bordering on the river Coroico abounded in many species of palms, chiefly *Maximilianas* and *Iriarteas*, the latter a singular kind with a trunk supported on long aërial roots. There were also many trees of *C. micrantha* on the banks of the Coroico, a species of chinchona, the peculiarity of which is its fondness for the bottoms of valleys and banks of rivers, while most of the others prefer elevated ridges or slopes of the mountains. With it were growing trees of the beautiful *Cascarilla magnifolia*, an allied genus with deliciously fragrant flowers.

The *cascarilleros* of Bolivia lead a hard and dangerous life. They only value the *C. Calisaya*, the other species being for them *carhua-carhua*, a name given to all the inferior kinds. Those who carry the bark on their shoulders from the interior of the forests receive fifteen dollars for every quintal, and they also have to carry all their provisions and covering for the night. If by any accident they are lost, or their provisions are destroyed, they die of hunger. Dr. Weddell, on one occasion, while ascending the Coroico, landed with the intention of passing the night on a beach well shaded by trees. Here he found the hut of a *cascarillero*, and near it a man stretched out on the ground in the agonies of death. He was nearly naked, and covered with myriads of insects, whose stings had hastened his end. His face was so swollen as to be wholly unrecognisable, and his limbs were in a frightful state. On the leaves which formed the roof of the hut were the remains of this unfortunate man's clothes, a straw hat and some rags, with a knife, and an earthen pot containing the remains of his last meal, a little maize, and two or three *chuñus*. Such is the end to which their hazardous occupation exposes the bark-collectors—death in the midst of the forests, far from all friends—a death without help, and without consolation.

Dr. Weddell returned to La Paz by ascending the Coroico, and the results of his second visit to the chinchona forests appeared in an entertaining book of travels.[82] To this able botanist and intrepid explorer science is indebted, to no small extent, for the present state of our knowledge of the chinchona genus.

The *C. Calisaya* species has been divided by Dr. Weddell into two varieties, namely, a *vera* and β *Josephiana*. The former, when growing under favourable circumstances, is a tall tree, often larger round than twice a man's girth, with its leafy head rising above all the other trees of the forest. The leaves are oblong or lanceolate-obovate, pitted in the axils of the veins, with a shining green surface, and reddish veins. The flowers, which hang in large panicles, are a rosy-white colour, with laciniæ rose-colour, and bordered by marginal white hairs. The capsule is smooth, and about twice as long as broad. This tree grows on declivities, and steep rugged places of the mountains, from 4900 to 5900

feet above the sea, in the forests of Enquisivi, Capaulican, Apollobamba, and Larecaja in Bolivia, and of Caravaya in Peru. The trunk may be known by the periderm of the bark, sometimes of a greyish-white, sometimes brown or blackish, being always marked by longitudinal ridges or cracks, a characteristic remarked of no other tree of these forests, excepting one or two of the same family. The taste is strongly bitter, which is apparent directly the tip of the tongue touches it, and, when the exterior receives a cut, a yellow gummy resinous matter exudes from it. The bark comes off with great ease, like peeling a mushroom, while, in the inferior kinds, and above all in the false chinchonas, it strips transversely, and with much greater difficulty. A good tree yields 150 to 175 pounds of dried bark.

The other variety of *C. Calisaya*, called *ychu cascarilla*, or *cascarilla del pajonal*, by the natives, was named *Josephiana* by Dr. Weddell after the unfortunate French botanist Joseph de Jussieu. It is a shrub, not attaining a greater height than six and a half to ten feet, and growing on open grassy slopes, at much higher elevations than the tree *Calisaya*. There is another tree variety with a somewhat darker leaf, which Dr. Weddell classed as a distinct species, and called *C. Boliviana* in 1849, but which he now considers to be a mere variety of *C. Calisaya*. The other good kinds in the forests of Bolivia and Caravaya are *C. micrantha*, and two varieties of *C. ovata*.

Dr. Weddell brought seeds of *C. Calisaya* to Paris, which were raised in the Jardin des Plantes in 1848, and others in the garden of the Horticultural Society in London, where one of the plants flowered.[83] Many of these plants were given away, and some of them were sent by the Dutch Government to Java.

Plants of *C. Calisaya* are now flourishing in India. The yield of quinine for the best kinds of *calisaya* bark is 3.8 per cent., that for the *Josephiana* variety 3.29.[84]

Arica and Islay are the ports for the shipment of *calisaya* bark; and in 1859 the quantity and value exported were:—

From	Arica	1926	quintals, worth	£17,334
"	Islay	1365	" "	12,383
		3291		29,717

Jan. 1st to Nov. 30th, 1860, Arica $160,260 = £35,000 (about).
1860, Islay, 1077 quintals.

CHAPTER III.

Rapid destruction of chinchona-trees in South America—Importance of their introduction into other countries—M. Hasskarl's mission—Chinchona plantations in Java.

THE collection of bark in the South American forests was conducted from the first with reckless extravagance; no attempt worthy the name has ever been made either with a view to the conservancy or cultivation of the chinchona-trees; and both the complete abandonment of the forests to the mercy of every speculator, as in Peru, Ecuador, and New Granada, and the barbarous meddling legislation of Bolivia, have led to equally destructive results. The bark-collector enters the forest and destroys the first clump of chinchona-trees he finds, without a thought of any measure to preserve the continuance of a supply of bark. Thus, in Apollobamba, where the trees once grew thickly round the village, no full-grown one is now to be found within eight or ten days' journey:[85] and so utterly improvident are the collectors that, in the forests of Cochabamba, they bark the tree without felling, and thus ensure its death; or, if they cut it down, they actually neglect to take off the bark on the side touching the ground, to save themselves the trouble of turning the trunk over.[86]

A century ago Condamine[87] raised a warning voice against the destruction that was going on in the forests of Loxa. Ulloa[88] advised the Government to check it by legislation; soon afterwards Humboldt reported that 25,000 chinchona-trees were destroyed every year, and Ruiz[89] protested against the custom of barking the trees, and leaving them to be destroyed by rot. But nothing was ever done in the way of conservancy, either by the Government, or by private speculators whose subsistence depended on a continued supply of bark. Dr. Weddell, alluding to this recklessness as regards *C. Calisaya*, observes that "the forests of Bolivia, rich as they are, cannot long resist the continued attacks to which they have been recently exposed. He who, in Europe, sees these enormous and ever-increasing masses of bark arrive, may perhaps believe that they will continue to do so; but he who sees the chinchona-trees in their native forests, and knows the real truth, is obliged to think otherwise."

There is, however, no danger of the actual extirpation of the trees unless the plan is adopted of leaving them standing, and stripped of their bark, as in the Loxa forests. Poeppig says that, in these cases, the trees in the tropical forests are attacked by rot with extraordinary rapidity; hosts of insects penetrate the stem to complete the work of destruction, and the healthy root becomes infected. Thus the valuable species called *C. Uritusinga* has really been almost exterminated.

But where the trees are felled it is only necessary to observe the precaution of hewing the stem as near as possible to the root, in order to be sure of its after-growth.[90] Under these circumstances, after six years the young trees are ready to be felled again in the milder regions, and after twenty years in cold and exposed localities. From the base of the stems, when not barked, a number of shoots spring out between bark and wood; and Dr. Karsten says that, though an interval of rest of twelve or fifteen years must be given to the forests where the chinchona-trees have thus been felled, this only promotes further investigation in the endless untrodden forests, while, in the mean time, the younger generation is growing up in those which have already been exhausted.[91]

The danger, therefore, is not in the actual annihilation of the chinchona-trees in South America, but lest, with the increasing demand, there should be long intervals of time during which the supply would cease, owing to the forests being exhausted, and requiring periods of rest. In many districts this is already the case. The bark which comes from Loxa is in the minutest quills, and in the forests of Caravaya, after an interval of rest of several years, the root-shoots had scarcely grown to a sufficient size to yield anything but quill bark. Then again the supplies of bark from South America are not nearly sufficient to meet the demand, and the price is kept so high as to place this inestimable remedy beyond the means of millions of natives of fever-visited regions. For these reasons the incalculable importance of introducing the chinchona-plant into other countries adapted for its growth, and thus escaping from entire dependence on the South American forests, has long occupied the attention of scientific men in Europe.

In 1839 Dr. Royle, in his 'Illustrations of Himalayan Botany,'[92] recommended the introduction of the chinchona-plants into India, pointing out the Neilgherry and Silhet hills as suitable sites for the experiment, and Lord William Bentinck took some interest in the project. M. Fée had previously recommended the introduction of these plants into the French colonies;[93] and in 1849 both Dr. Weddell[94] and M. Delondre[95] strongly urged the adoption of this measure. The former declared that posterity would bless those who should carry this idea into execution.[96]

The Dutch, who possess in the island of Java a range of forest-covered mountains admirably adapted for chinchona cultivation, were, however, the first to take active steps for its introduction into the Eastern Hemisphere; and their praiseworthy exertions deserve, what they lay claim to with justice, the approbation of the whole civilized world. The experiment in Java, however, has only been tried with a very limited number of valuable species of chinchonæ, and has met with very limited success, owing to the introduction of worthless kinds, and to mistakes in the cultivation, committed during the first few years.

For the last thirty years Dutch scientific men, among whom the name of the botanist Blume may be mentioned, had urged their Government to undertake the introduction of

chinchona-plants into Java. But it was not until the year 1852 that M. Pahud, the Dutch Minister of the Colonies, was authorized to employ an agent to collect plants and seeds of valuable species in Peru, and to convey them to Java. He selected, for this important mission, M. Justus Charles Hasskarl, a botanist who had for some time superintended the gardens in Java, but who was a stranger to South America—ignorant of the country, the people, and the languages—unacquainted with the forests where the chinchona-trees are found, and who had never seen them growing in their natural state. He sailed for Peru in December, 1852, with orders not to confine himself to the *Calisaya* plant, but to collect plants and seeds of as many different species as possible. His original orders were to proceed from Guayaquil to the chinchona-forests of Loxa in the first instance; but he changed his plan, and, landing at Lima, crossed the cordilleras in May, 1853.

It would be difficult, in making a chance journey from the coast to the forests of the Eastern Andes, to hit upon a part where valuable species of chinchona-trees are not known to exist. There are such spaces—forest tracts—intervening between the more favoured regions, where only species of little value are found, such as *C. pubescens*, *C. scrobiculata*, &c.; and on one of these, between the region of grey barks in Huanuco and that of *C. Calisaya* in Caravaya, M. Hasskarl, through being unacquainted with the localities, was so unfortunate as to stumble. He crossed the Andes by the road from Lima to Tarma, and descended the eastern slopes into the montañas of Vitoc, Uchubamba, and Monobamba; returning thence by Xauxa into the loftier region of the Andes. Near Uchubamba he saw trees which he believed to be *C. Calisaya*; but that species is never found to the north of the province of Caravaya. He however collected a quantity of seeds of this imaginary *C. Calisaya*, and four packets of a species which he called *C. ovata*, with smaller quantities of *C. pubescens* and *C. amygdalifolia*.

The species called by M. Hasskarl *C. ovata* now forms the bulk of the chinchona-plantations in Java. He found it on dry sunny hills, without much shelter from the sun, in a very sandy micaceous soil, at an elevation of 5500 to 6000 feet above the sea. It is sometimes a mere shrub, but occasionally rises to fifteen or twenty-five feet, with elegant pink flowers and reddish fruit. The native name is *cascarilla crespilla chica*; and as the *crespilla grande* is the *C. ovata* of Weddell, it is probable that M. Hasskarl was thus led into the mistake of calling his new species *C. ovata*. The leaves are smooth above, with a felt-like pubescence on the under surface, and the hairy capsules are probably an indication of the worthlessness of the species.[97] In fact, no good kinds are found in this part of the country, and all the seeds sent home by M. Hasskarl were equally valueless. He collected specimens of *C. lanceolata* of Pavon, at a place called "Escalera de San Rafael," on the road between Uchubamba and Xauxa.[98]

From Xauxa M. Hasskarl went to Cuzco, and thence in September to Sandia in the province of Caravaya; but finding that the seeds of chinchona-trees are ripe in August, and that he had arrived too late, he returned to Lima, and finally took up his abode at

Arequipa until the following year. In March, 1854, he again set out, crossed the Andes to Puno, and, after wandering over part of Bolivia, at length reached the little village of Sina in Caravaya, near the frontier between Peru and Bolivia, in April. He had assumed the feigned name of José Carlos Müller, and had printed it on his cards, one of which he presented to the governor of Sina, Don Juan de la Cruz Gironda, requesting him to procure a supply of chinchona-plants for him. Gironda refused, but introduced the stranger to a Bolivian named Clemente Henriquez, a clever and intelligent, but dishonest and unscrupulous man. Henriquez agreed to procure 400 plants of *C. Calisaya* for a certain sum, part of which was to be paid down, and the remainder on delivery of the plants. M. Hasskarl then went on to the village of Sandia, where he took up his abode, without entering the chinchona forests, and waited there until the plants should arrive. Meanwhile Henriquez employed an Indian to collect the stipulated number of plants, round a place called Ychu-corpa,[99] on the frontier of Bolivia; and when they were brought to him he went to Sandia, delivered them to M. Hasskarl, and received his money. An outcry was afterwards raised against Henriquez, by the people inhabiting villages bordering on the chinchona forests, who considered that their interests would be injured by the exportation of the plants: they declared they would cut his feet off if they caught him, and he has ever since been obliged to live at Pelechuco, in Bolivia.[100] This feeling has rendered any future operations of a like nature exceedingly difficult.

M. Hasskarl left Sandia with these plants in June, 1854, but they were not placed in Wardian cases at the port of Islay until August, and on the 27th of that month he finally left the coast of Peru in a sailing vessel, and shaped his course direct for Java.[101] He arrived at Batavia with twenty Wardian cases on December 13th, but all his plants have since died except two.[102] On his arrival M. Hasskarl was intrusted with the cultivation of chinchona-plants in Java, with the rank of Assistant-Resident, and was made a Knight of the Netherlands Lion, and Commander of the Order of the Oaken Crown.[103]

Besides the plants brought by M. Hasskarl, a plant of *C. Calisaya*, raised in Paris from seeds sent home by Dr. Weddell, had arrived in Java; as well as plants raised from seeds previously sent from Peru, and seeds of *C. lancifolia* sent by Dr. Karsten from New Granada, through the Governor of Curaçoa; and thus the experimental chinchona cultivation in Java was commenced.

Although through various circumstances the mission to South America was not very successful, yet M. Hasskarl deserves the greatest credit for the zeal and determination displayed by him in his journeys, during which he was surrounded by no ordinary amount of difficulties and dangers. He certainly proved himself to be a most indefatigable and courageous traveller.

M. Hasskarl, and his associate M. Teysmann, selected the site for the first chinchona plantation, at a place called Tjibodas, thirty miles south of Batavia, on the northern

slope of the volcanic range which traverses Java from east to west, and 4400 feet above the sea. Ground was also prepared at Tjipannas, half a mile above Tjibodas, and 4700 feet above the sea. These sites were covered with rasamala-trees of immense size (*Liquidambar Altingia*,[104] *Blume*), which had to be felled. The superintendents, deceived by the sight of such large trees, imagined that the soil was deep and good, but in reality it was not more than six inches deep, and underneath there was a formation completely impenetrable to roots, called *tjadas*, composed of sand and small stones of trachytic origin, strongly cemented together by crater slime, the whole being as hard as rock. Not one of the huge rasamala-trees in reality pierced this *tjadas* with their roots, but ran along its surface horizontally for hundreds of feet. In these localities the chinchona-plants continued to languish during the year 1855, and in the end of that year the experiment presented a most hopeless appearance.

The causes of this failure are sufficiently evident. After the felling of the rasamala-trees, the young chinchona-plants were exposed to the full force of a burning sun, without any shade whatever, in an extraordinarily thin soil upon a rocky bank impenetrable to roots. The dead and rotted roots of the rasamala-trees were allowed to remain, developing fungi which attacked the chinchona-roots; and the sites themselves were in much too low and warm a climate. In consequence of the combined effects of these adverse influences, there were only 300 chinchona-plants in Java, in a sickly unpromising condition, after the lapse of the first eighteen months.

In December, 1855, Dr. Franz Junghuhn came to Java with 139 chinchona-plants, raised from seeds in Holland. They were delivered over to M. Hasskarl, and in six months seventy-six of them were dead. In June, 1856, M. Pahud, who had been Minister of the Colonies, and was then Governor-General of Netherlands India, relieved M. Hasskarl of his duties, and gave the entire charge of the chinchona experiment to Dr. Junghuhn, an experienced scientific botanist. Dr. J. E. de Vry, a chemist of some eminence, was also sent to Java, charged with the special duty of applying chemical tests to the barks of the chinchona-plants, to ascertain their intrinsic value.

When Dr. Junghuhn took charge the prospects of the experiment were very far from promising, and he has displayed an amount of intelligent perseverance, combined with much practical knowledge, which is deserving of all praise. He found the 139 chinchona-plants which he himself brought out reduced to sixty-three; the seeds of *C. lancifolia* represented by three sickly plants; the collection of plants of *C. Calisaya* brought by M. Hasskarl from Peru, also reduced to three; two plants of *C. Calisaya* raised from seeds sent home by Dr. Weddell; and the remainder, consisting of the worthless species collected by M. Hasskarl in Uchubamba, making a total of only 300 plants.

In 1856 a new system was introduced, money was lavishly expended, an efficient establishment was formed, and a great effort was commenced to secure the successful

cultivation of the chinchona-plants. The superintendent receives 1350*l.* a year, the chemist 1100*l.* a year, and under them there are eight Dutch overseers; the total amount paid in salaries being 3256*l.* a year.[105] It was ordered that, until the cultivation is considered as quite successful, it should remain under the management of scientific men, but that finally it should be handed over to the ordinary direction of the chiefs of the provincial government, under the Director of Cultures; and a memorandum of instructions, consisting of eighteen articles, was drawn up for the guidance of Dr. Junghuhn and his subordinates.

Finding the chinchona-plants in so deplorable a condition, one of Dr. Junghuhn's first measures was to transplant them from Tjibodas to a more suitable site on the Malawar mountains, a very delicate and hazardous operation, which was, however, successfully performed: in 1857 plants both of *C. Calisaya* and of the worthless species blossomed, and in 1858 bore fruit. Dr. Junghuhn found that the latter could not be the *C. ovata* as named by M. Hasskarl; but he was himself equally mistaken in naming it *C. Lucumæfolia*, from a fancied resemblance to that species of Pavon.[106] The great mistake of the Dutch has been in propagating this worthless species, and spending vast sums of money on its cultivation, tempted by finding that its nature was hardy, and that it required less care than the delicate *C. Calisaya*.

In 1858 several of the plants sickened from the attacks of destructive insects (*Bostrichus* or *Dermestes*), not larger than the head of a pin, which pierced horizontally into the bark and wood of the stem and branches, where they laid their eggs and died. Dr. Junghuhn conjectures that they were imported from Peru; as they are not natives of the Java forests, and I found these boring insects in the wood of chinchona-trees in the forests of Caravaya. Twenty-nine trees were thus attacked in Java, and died.

Dr. Junghuhn established his new plantations on the slopes of the Malawar mountains, where he has found that the *C. Calisaya* is much more sensitive than his so-called *C. Lucumæfolia*; and that very slight differences in temperature, in elevation, in light, in shade, and in moisture, exercise a very evident influence on the former, while the latter remain quite unaffected by them. He considers that the best conditions for the growth of *C. Calisaya* on the Malawar mountains (between latitude 7° and 8° S.) are good loose forest soil and moderate shade, at an elevation from 5000 to 5700 feet above the sea. The *C. Calisayas*, when they receive light only on their crowns, and are surrounded by the dark wood, have a rapidly rising, slender, tall stem, devoid of side branches; whilst, when they stand on clear open spots, they grow much stronger in width and thickness, but are shorter, and have numerous side branches.

The following is Dr. Junghuhn's method of cultivation. Pots, made of bamboo-joints, are loosely filled with finely-sifted earth, composed of one-fourth part of black volcanic sand (felspar, hornblende, and magnet iron) mixed with brown forest soil. The pots are then placed in the interior of the forests, on beds of heaped-up earth laid out in the form

of terraces, on the declivities of the mountains. A roof of dry grass, supported by stakes, and high enough to admit a side light, protects the pots from the falling rain-drops. These seed-beds are from 200 to 500 feet long, and extend in parallel lines between the trees, like the steps of an amphitheatre. Each pot receives only one seed, and the earth is kept constantly moist by watering twice daily with the squeeze of a sponge.[107]

The pots remain standing on the seed-beds until the plants are about half a foot high, which takes about eight months; and during this time they are turned every five or eight days, in order to prevent the crooked growth of the plants, which always turn to the side where most light falls on the beds. For the purpose of planting out, a few principal broad roads are made along the mountain ridge through the wood, united at intervals by cross footpaths, twenty-five feet asunder. At the side of these footpaths, and twenty-five feet from each other, wide trenches are dug, and filled up with cleansed earth, so as to make slightly raised mounds, with gutters to carry off the rain-water. The young plants are placed in the loose earth on these mounds, and four strong stakes, driven into the ground round them, are fastened together four or five feet above their heads. This protects them from falling boughs, drip, and wild animals, for some years. Thus thousands of paths have been cut in the forests, and planted with chinchona-trees, which are growing well. There are now nine nurseries in Java—Tjibodas on Mount Gêdé; Tjiniruan on the south-west slope, and Tjiborum on the southern slope of Mount Malawar; Genting; Reong Gunung; Kawah Tjirvidei in the Kendeng mountains; one on Mount Patna; and two others.

Dr. Junghuhn, in adopting the above method of cultivation, and in altering M. Hasskarl's arrangements, has run into an opposite extreme. His system of planting the young chinchonas in the forests under dense shade[108] is most erroneous; and the way in which the seeds are treated quite accounts for the small number which germinate.

On the 31st of December, 1860, the number of chinchona-plants in Java was as follows:—

C. Calisaya	7,316	plants,	and	1030	cuttings.
C. lancifolia	80	"	"	28	"
Species procured by M. Hasskarl	939,809	"	"	18	"
Total	947,205	plants.[109]			

Besides 700,264 seeds in stock, or sown. The extreme height attained by the tallest *C. Calisaya* was, at the same date, fifteen feet, and by the worthless species twenty-eight feet. One of the trees of *C. lancifolia* had also attained a height of fifteen feet.

Dr. de Vry, the eminent chemist who is associated with Dr. Junghuhn, and who had for two years previously occupied himself with the study of the chinchona alkaloids, has been actively engaged in careful investigations of the chinchona barks in Java. With

regard to the *C. Calisaya* his results have been very satisfactory. From the trunk-bark of a plant of this species, six years old, he obtained, in August, 1860, 5 per cent. of alkaloids; and from that of the branches, 2½ per cent. But the specimens of *C. Calisaya* bark from Java, which have been sent to the Exhibition of 1862, have a very different appearance, and are much thinner than those from South America. This circumstance leads to the inference that the present system of cultivation in Java is erroneous. With the species introduced by M. Hasskarl, Dr. de Vry was not so successful. The leaves, flowers, fruit, and bark of this species were sent to Mr. Howard by Dr. Junghuhn; and it was found that the names of *C. ovata*, given it by M. Hasskarl, and of *C. Lucumæfolia* by Dr. Junghuhn, were equally erroneous. It was clear that it was one of the numerous worthless species, not previously described, and Mr. Howard, in the seventh number of his work, has named it *C. Pahudiana*,[110] after M. Charles F. Pahud, who, as Minister of the Colonies, sent M. Hasskarl to South America in 1852, and who, being appointed Governor-General of Netherlands India in 1855,[111] did so much to ensure the success of the chinchona experiment in Java. Up to 1860 Dr. de Vry had only obtained 0.4 per cent. of alkaloids from the bark of *C. Pahudiana*, and Mr. Howard's examination coincides with the analysis of Dr. de Vry in pronouncing it an inferior sort. In 1861, however, he obtained 3 per cent. of alkaloids from the bark of the roots of a *C. Pahudiana* plant eight years old, and 1¼ per cent. from the trunk-bark. From a tree aged two years and three months he only got 0.09 per cent. from the trunk-bark, and 1.9 per cent. from the root-bark, of which he states the greater part to be quinine; while in the trunk-bark there was not a trace of that alkaloid. This result leads Dr. de Vry to conjecture that the quinine, once formed in the roots, is employed in the growth of the plant, and that, when it attains its full growth, the trunk-bark will also be rich in quinine. If this should not be the case, he hopes that the roots of the young plants may be used profitably for the manufacture of quinine. It is to be feared that the quinine in the trunk-bark will not increase with age, for, while in the younger tree there was 1.9 per cent. of alkaloids in the roots, chiefly quinine, and 0.09 in the trunk-bark, in the older one there was 3 per cent. in the roots, of which 1.8 was quinine, and 1¼ per cent. in the trunk-bark, in which there was only the minutest trace of quinine. Thus, while the quantity of quinine decreased or remained stationary in the roots, the trunk-bark was still destitute of that precious alkaloid.

It is possible that Dr. de Vry, in his earnest desire to discover quinine in a species upon which so much labour and anxiety, and such vast sums of money, had been expended, may have been deceived by appearances. Both from the form of the capsules, the absence of quinine in the upper bark, and the locality whence it was procured, there is every reason to fear that the *C. Pahudiana* is a worthless kind; and the bark of this species, which has been sent to the Exhibition of 1862, is so evidently valueless that no dealer would buy it. In all valuable species there is a good percentage of alkaloids in the upper bark, and a very much smaller proportion, which, too, is amorphous and of

little commercial value, in the bark of the roots. This law of nature, the existence of which is proved by all experience, would have to be reversed in order to enable the Dutch to extract large supplies of quinine from the roots of a species, such as *C. Pahudiana*, which contains none in the upper bark.

It is much to be regretted that the scientific men in Java, instead of exerting all their skill and talent in the work of cultivating *C. Calisaya* and *C. lancifolia*, of the value of which there is no doubt, should have filled the forests of Java with a kind which from the first was known to be of very doubtful value, was unknown in commerce, and the cultivation of which will, it is to be feared, only end in loss and disappointment.

The valuable species were found to be much more tender, and more sensitive to external unfavourable influences, than the *C. Pahudiana*; the latter was therefore propagated rapidly, and unwisely allowed to outstrip the other kinds in the race, and the consequence has been that it has gained an immense preponderance. Thus, so far as valuable species of chinchona-plants are concerned, the Dutch experiment in Java has been attended by a very small measure of success. After three years the Dutch gardeners only had forty plants of valuable species in Java, and after six years they had only increased their stock to seven thousand plants. It will presently be seen that far greater results were attained in India within eighteen months of the first introduction of the chinchona-plants.

	1857.[9] At Tjibodas.	December, 1859.[112]	December, 1860.[113]	1861.
C. Calisaya	37	3,201	7,316	?
C. lancifolia	3	45	80	?
C. Pahudiana	60	96,838	939,809	Millions.

Yet, so great are the difficulties of this most important undertaking, that, in spite of the comparative failure in Java, the highest praise and admiration are due both to M. Hasskarl and to his successors. They have devoted great ability, no ordinary amount of scientific knowledge, and untiring perseverance to this good work; and, now that they have received plants of other really valuable species from India, there is a prospect that the chinchona cultivation in Java may eventually attain such a measure of success as will entitle Dr. Junghuhn and Dr. de Vry to the gratitude of their countrymen.[114]

CHAPTER IV.

INTRODUCTION OF CHINCHONA-PLANTS INTO INDIA.

PRELIMINARY ARRANGEMENTS.

THE distribution of valuable products of the vegetable kingdom amongst the nations of the earth—their introduction from countries where they are indigenous into distant lands with suitable soils and climates—is one of the greatest benefits that civilization has conferred upon mankind. Such measures ensure immediate material increase of comfort and profit, while their effects are more durable than the proudest monuments of engineering skill. With all their shortcomings, the Spaniards can point to vast plains covered with wheat and barley, to valleys waving with sugar-cane, and to hill-slopes enriched by vineyards and coffee-plantations, as the fruits of their conquest of South America. On the other hand, India owes to America the aloes which line the roads in Mysore, the delicious anonas, the arnotto-tree, the sumach, the capsicums so extensively used in native curries, the pimento, the papaw, the cassava which now forms the staple food of the people of Travancore, the potato, tobacco, Indian corn, pine-apples, American cotton, and lastly the chinchona: while the slopes of the Himalayas are enriched by tea-plantations, and the hills of Southern India are covered with rows of coffee-trees.

It is by thus adding to the sources of Indian wealth that England will best discharge the immense responsibility she has incurred by the conquest of India, so far as the material interests of that vast empire are concerned. Thus too will she leave behind her by far the most durable monument of the benefits conferred by her rule. The canals and other works of the Moguls were in ruins before the English occupied the country; but the melons which the Emperor Baber, the founder of the Mogul dynasty, introduced into India, and which caused him to shed tears while thinking of his far-off mountain-home, still flourish round Delhi and Agra. Centuries after the Ganges canal has become a ruin, and the great Vehar reservoir a dry valley, the people of India will probably have cause to bless the healing effects of the fever-dispelling chinchona-trees, which will still be found on their southern mountains.

The introduction of the chinchona-plant into India was surrounded by difficulties from which all other undertakings of a similar nature have been free. When tea was introduced into the Himalayan districts, it had been a cultivated plant in China for many ages, and experienced Chinese cultivators came with it. But the chinchona had never been cultivated; since the discovery of its value in 1638 it had remained a wild forest tree; all information concerning it was solely derived from the observations of

European travellers who had penetrated into the virgin forests; and the only guidance for cultivators in India is to be found in the reports of these travellers, and in the experience slowly acquired by careful and intelligent trials.[115] Great as these difficulties were, they were probably exceeded by the perils and risks of every description which must be encountered in collecting plants and seeds in South America, and conveying them in safety to India.

But the vast importance of the introduction of these plants into our Indian empire, and the inestimable benefits which would thus be conferred on the millions who inhabit the fever-haunted plains and jungles, were commensurate with the difficulties of the undertaking. The subject had occupied the attention of the Indian Government from time to time, ever since Dr. Royle in 1839 advocated the introduction of quinine-yielding trees into India, in his work on Himalayan Botany; but it was not until twenty years afterwards, in 1859, that any adequate steps were taken to effect this most desirable end, and to bring an antidote within the reach of the fever-stricken people of India, while adding a new source of wealth to the resources of that great dependency.

The proposal to introduce the chinchona-plants into India was first made officially in a despatch from the Governor-General, dated March 27th, 1852. It was referred to the late Dr. Royle, the reporter on Indian products to the East India Company, who drew up an able memorandum on the subject, dated June, 1852:—"To the Indian Government," he said, "the home supply of a drug which already costs 7000*l.* a year would be advantageous in an economical point of view, and invaluable as affording means of employing a drug which is indispensable in the treatment of Indian fevers. I have no hesitation in saying that, after the Chinese teas, no more important plant could be introduced into India." The only result of this application from India was that the Foreign Office was requested to obtain a supply of plants and seeds from the consuls in South America, and instructions to that effect were sent out to them in October, 1852. In the autumn of 1853 Mr. Mark wrote from Bogota that some delay would be necessary, and nothing more was heard from that quarter; Mr. Sullivan, the consul-general in Peru, replied that it would be impossible to accomplish a successful result, through the jealousy of the people; but Mr. Cope, the excellent and venerable consul-general at Quito, made a more satisfactory and substantial answer, in the shape of a box of chinchona plants and seeds from Cuenca and Loxa. They, however, did not long survive the voyage to England. Seeds of *C. Calisaya*, procured through Mr. Pentland, were sent to the botanical gardens at Calcutta, but did not germinate; and in 1853 six plants of the same valuable species, contributed by the Horticultural Societies of Edinburgh and London, raised from seeds sent home by Dr. Weddell from Bolivia, were taken out to Calcutta by Mr. Fortune. They arrived in good order, but all died through gross carelessness in their removal to Darjeeling. In May, 1853, Dr. Royle drew up a second long and valuable report upon the subject, and the question was then allowed to drop for some years.

It is a curious coincidence that at the very time when Dr. Royle was writing this report I was actually exploring some of the chinchona forests of Peru. But the object of my travels was of an antiquarian and ethnological character, and I was in ignorance of the desire of the Indian Government to procure supplies of those plants, which I then only admired for their beauty.

In March, 1856, Dr. Royle made a final attempt to induce the East India Company to take efficient steps to procure supplies of chinchona plants and seeds from South America; and proposed to employ Dr. Jamieson, the able Professor of Botany in the University of Quito, for this purpose. The lamented death of that eminent botanist Dr. Royle, to whom India owes so much, again put an end to all discussion of the subject for some time; but in 1859 energetic measures were set on foot, which at length effected the desired object fully and completely. Dr. Royle is well known as the author of works on Himalayan botany, on the cotton cultivation and on the fibres of India, and of a 'Materia Medica' containing a valuable article on the chinchona genus, which he caused to be printed separately for circulation in India. For several years he took the warmest interest in the proposed measures for the introduction of chinchona-plants into India, and used every influence at his command to effect this most important object. But he was not destined to see the final achievement of a design which he seems to have had so much at heart.

In 1859 my services were accepted to superintend the collection of chinchona plants and seeds in South America, and their introduction into India; and I was authorised by Lord Stanley, then Secretary of State for India, to make such arrangements as should best ensure the complete success of an enterprise, the results of which were expected to add materially to the resources of our Indian Empire. The urgent necessity of this measure had become more apparent since Dr. Royle's time. Then the Government of India expended 7000*l.* a year upon quinine; but in 1857 the expenditure had risen to 12,000*l.*, and continued to increase during the following years.[116]

I at once determined to take measures for obtaining plants and seeds of all the valuable species of chinchonæ described in a former chapter; to arrange so that, if possible, they should be collected simultaneously in the different regions separated by many hundreds of miles from each other; and that, warned by the fatal error of the Dutch in Java, no species should be introduced into India which did not possess bark of well-established commercial value. In one of his reports Dr. Royle had most truly said that "the greater the number of species obtained, as well as the greater the extent of country over which the seeds are collected, the greater is the probability of finding soils and climates in India for their successful culture." It was thus necessary to employ competent persons to collect in New Granada, Ecuador, the Huanuco forests of Northern Peru, and Caravaya or Bolivia at the same time. I considered that it was essential that the proceedings should be completed during the first year if possible, in order to give as short a time as

was practicable for the awakening of that narrow-minded jealousy in the people of the South American Republics, which I was well aware would sooner or later be aroused. It was also my duty to get the work done economically, and there could be no doubt that the employment of several agents for a few months would cost less than the mission of a single traveller, who would have to make his way over thousands of miles, for three or four years. Time also was an object with regard to the establishment of plantations in India.

The Secretary of State for India sanctioned all the details of my plan, with the exception of the expedition to New Granada,[117] and the provision of a steamer to convey the plants direct across the Pacific to India. But it was no easy matter to find agents possessed of the necessary qualifications for the work. A personal acquaintance with the chinchona forests, a knowledge of the country, of the people, and of the languages, were essential, as well as of the particular species of chinchona-trees growing in each region; and, as the service was to be performed without delay, no time could be spared for acquiring any of these qualifications.

For the chinchona forests in Ecuador I was so fortunate as to secure the services of Mr. Spruce, an excellent botanist and most intrepid explorer, who had been engaged for several years in the examination of the wilds of South America, and who was actually on the spot. Of his qualifications there could be no doubt, but I could scarcely have ventured to hope that the service which he undertook to perform would have been done so completely and so thoroughly, and would have been crowned with such undoubted success. It is perhaps invidious to make distinctions, where all have worked so zealously; but it is due to Mr. Spruce to say that by far the largest share of credit is due to him, and that his name must take the most prominent place in connection with the introduction of these precious plants into India. The region assigned to him was the most important, as it yielded the "red-bark" tree (*C. succirubra*), containing a larger percentage of febrifugal alkaloids than any other species; and I felt more sanguine of success in this quarter than in any other, because the country of the "red bark" was more accessible than any of the others, the forests being on the western slopes of the Andes, navigable rivers flowing through them to the Pacific Ocean, and there being, therefore, no necessity of conveying the plants over the snowy wilds of the cordilleras. I also requested Mr. Spruce to make an arrangement for procuring seeds of the valuable species from the forests of Loxa.

For the forests of the Peruvian province of Huanuco I procured the services of Mr. Pritchett, a gentleman who had passed some years in South America, and who was well acquainted with that particular region. He was to collect plants and seeds of the species yielding grey bark.

I myself undertook to explore the forests either of Caravaya or Bolivia, and to collect the *C. Calisaya* and other important species of that more distant region. This part of the

enterprise was surrounded by peculiar difficulties, arising from the jealousy of the people, habitual with the Bolivians, and recently excited in the minds of the Peruvians of Caravaya by the proceedings of M. Hasskarl, the Dutch agent; while the forests are far more inaccessible, and the journey to the coast is longer and more formidable.

It was the opinion of Sir William Hooker, who gave me the advantage of his valuable advice, that a good practical working gardener should accompany both Mr. Spruce and myself, and he considered this an imperative requirement, in order that they might attend to the packing of the plants in the forests, their establishment in Wardian cases, and have charge of them during the voyage to India. I appointed Mr. Cross, at his recommendation, to act under the orders of Mr. Spruce; and Mr. Weir, who was recommended to me by Mr. Veitch, accompanied me to the chinchona forests of Caravaya.

In employing several agents in districts widely removed from each other, my chief object was to effect the introduction of as many valuable species as possible; but I also reflected on the extreme difficulty of the undertaking, and the overwhelming chances against success which confronted a single-handed attempt. In such wild unfrequented regions all is uncertainty. Along the dizzy paths of the Andes a single false step may dash the fairest hopes, disappoint the most careful calculations. Add to these dangers the probability of obstacles raised by the natives, and it will at once be seen that three independent expeditions materially increased the chances of ultimate success.

By the end of 1859 I had completed all the preliminary arrangements; and there was at length a prospect of securing the successful introduction into India of a plant the inestimable value of which had been felt, and the importance of its cultivation discussed, for twenty years. On December 17th, 1859, we sailed from England, and, crossing the isthmus of Panama, arrived in Lima, the capital of Peru, on January 26th, 1860. Thirty Wardian cases for the plants had been sent out round Cape Horn, and I forwarded fifteen to Guayaquil for Mr. Spruce's collection, and fifteen to the port of Islay in Southern Peru, to await my return from the chinchona forests. After a month's residence in Lima we embarked on board one of the mail-steamers for the southward, and on the 2nd of March, 1860, we landed at Islay, which is more conveniently situated than any other port for a journey to the chinchona forests of Southern Peru or Bolivia.

CHAPTER V.

ISLAY AND AREQUIPA.

THE port of Islay is the commercial outlet of the departments of Arequipa, Cuzco, and Puno, in Southern Peru; and thus a small town, dating from about 1830,[118] has risen up on the rocky barren coast, surrounded by a sandy desert, and shut in from the interior by a range of sterile mountains. The coast consists of inaccessible cliffs, perforated with deep caves by the incessant surge of the ocean, with several rocky islets off the shore. The anchorage[119] is formed by a slight indentation of the coast, and the landing is effected at a small iron jetty clamped to the rocks, under which the swell breaks and chafes with a ceaseless roar. A very steep path leads up the cliff to a custom-house, forming one side of the little *plaza*, which is constantly filled with droves of mules from the interior. A single street leading up from the plaza, with a few lanes off it, forms the town of Islay; and a brief statement of the trade of this port will give an idea of the importance of the country to which it forms an outlet.

The principal articles of export are alpaca and sheep's wool, vicuña wool, copper, bark, and specie; the total value in 1859 being 336,842*l.*,[120] and the value of the imports, consisting chiefly of European goods, is about equal to that of the exports.

The country round Islay is as dreary and arid a waste as the eye could rest on; yet from July to October, when there is the greatest amount of moisture on the coast, the otherwise barren mountains, which rise up abruptly from the desert, at a distance of about three miles from the sea, are green and carpeted with flowers, while the plain nearer Islay is also dotted over with vegetation. This maritime range is called the "Lomas." In consequence of the unusual quantity of rain which fell in the early part of 1860, the Lomas had broken out in renewed freshness in March. The country, close to Islay, was covered with a scattered growth of Compositæ, wild tobacco, Nympha, Oxalis, Salvia, an Umbellifer with a large white flower, Verbena, Heliotrope, a purple Solanum, an Amaranth, and other flowers. It is broken up into abrupt ravines; and, near the foot of the mountains, some of them contain deposits of soil washed down by little streams which flow during the wet season, sufficient to sustain small groves of fig and olive trees, the abodes of numerous flocks of doves. Such is the case in the ravines called Catarindo, Yutu, and Matarani, from the latter of which the water is led in pipes to supply the town of Islay. The guardian of this water-supply is an Irishman, generally known as Juan de la Pila (John of the fountain), an active obliging man, who also follows the trades of carpenter, cooper, and blacksmith; and to whom we were indebted

for much valuable assistance in procuring soil for the Wardian cases, and in giving us the use of his yard.

The soil in the richest parts of these ravines, which had been washed down from the higher slopes of the Lomas, is several feet deep, and appeared sufficiently good to be used for the Wardian cases, in the event of its being found impossible to obtain soil from any more promising locality; and the great number of wild flowers which were growing in it convinced me that it could not contain anything very pernicious.[121]

The formation consists of granite, with veins of very pure quartz; but the plains are covered with large patches of fine dust, consisting chiefly of silica, containing potash and mica, with small quantities of the débris of the rocks associated with the soil, which Admiral FitzRoy suggests may have been the ashes ejected, at some remote period, from the volcano of Arequipa. Near the sea-shore, and about half a mile south-east of Islay, there is a very curious result of the constant action of the weaves, in two immense cavities hollowed out of the rock, called the *Tinajones* (jars). They are circular holes about thirty yards across, and of great depth, separated from the sea by a wall of cliffs not more than four yards wide, the lower part of which is undermined, and forms a passage by which the waves rush into the great *tinajon*, or bowl, with a mighty roar; and, dashing themselves against the rocky sides, throw back clouds of white spray. The only vegetation near the coast consists of lowly little *Mesembryanthema*, scattered about at long intervals, and an occasional stonecrop (*Sedum*).

During our stay at Islay we enjoyed the hospitality of Mr. Wilthew, H.B.M. Consul, and his wife, to whom we were indebted for much thoughtful kindness. The rest of the inhabitants consist of Peruvian officials, agents of commercial houses in Arequipa, and a few shopkeepers and artisans, besides the muleteers and other birds of passage, and the porters and boatmen of mixed Indian and negro extraction. The supplies for the market come almost entirely from the rich valley of Tambo, some leagues down the coast.

On March 6th, our mules and horses having arrived, we started for Arequipa in the morning, a distance of ninety miles, and, crossing the country near Islay, entered a gorge in the mountains, which winds up to the great desert above, at the commencement of which there is a grove of dusty olive-trees. This dismal ravine, with arid scarped mountains rising up on either side, here and there a tall gaunt cactus, and everywhere a dense cloud of white dust, leads up to a little post-house built of canes, called the "Tambo de Guerreros," eighteen miles from Islay.

Guerreros is at the head of the gorge leading down to Islay; and, from a rising ground a little beyond the tambo,[122] the great desert of Arequipa opens upon the view, bounded by a range of mountains which are crowned by the snowy peak of the volcano. At this point there is a wooden cross which marks the grave of a poor soldier belonging to the

fugitive army of Salaverry, in 1836, who, worn out with fatigue and thirst, had here sunk down to die, and had been lightly covered over with sand. The flesh was in perfect preservation. We then entered the great desert of Arequipa, extending to the horizon on the right and left, and ending in front at the foot of the rocky range of mountains separating the sandy waste from the fertile campiña of Arequipa. The desert consists of hard ground, without a blade of vegetation, affording good riding; but it is covered at short intervals with mounds of the finest white sand, from twenty to thirty feet high, all in the shape of a half-moon, with their horns pointing north-west, and thus denoting the prevailing wind. They are called *Medanos*. These *Medanos* shift their positions, and the breeze, whirling the sand in eddies on their summits, often causes a singing noise in the early dawn. Frequently they form athwart the road, which has to deviate in a half-circle, and rejoin the old track on the other side; but they all resemble each other exactly, and afford no landmark to the lost or benighted traveller.

In the centre of the desert is the post-house or tambo of La Joya, twenty miles from Guerreros, kept by an Englishman, whose homely name of Jimmy Eyres has been converted into the more grandiloquent and euphonious Spanish one of Don Santiago Casimiro de los Ayres. Water and fodder for the beasts are brought from a great distance, and their price is of course proportionately high; but, considering its position in the midst of a desert and many leagues from all supplies, the little tambo, consisting of several rooms of deal planking roughly knocked together, was very comfortable.

Starting at four on a bright starlight morning, the perfect stillness and the wild grandeur of the boundless desert were very impressive, while there was a delicious freshness in the cool air. As the sun rose behind the mighty cordilleras which bounded the view, the whiteness of their snowy peaks became quite dazzling. Immediately in front was the perfect cone of the volcano of Arequipa; to the right the glorious peaks of Charcani and Chuquibamba; to the left the remarkable range of Pichupichu. It is probable that in no part of the world is so sublime a view of mountain peaks to be found as is presented at early dawn from this desert. But its sublimity is similar to that which is witnessed in a sunrise at sea; it fills the mind with an idea of vastness and grandeur, while it wants all the details which usually accompany and form no small part of the enjoyment derived from ordinary mountain scenery. Yet here, while gazing on those magnificent peaks, with no middle distance and no foreground, save the flat sea-like wilderness, we felt that any addition would have marred the simple glories of this unparalleled view. The desert is between 4000 and 5000 feet above the sea, and the cordillera peaks are, some more, some a little less, than 20,000 feet in height; so that, within a distance of under forty miles, we beheld mountains rising upwards of 16,000 feet from the point on which we stood: of no other mountains in the world could such a view be obtained. In this land of the Incas Nature has done her work on a truly gigantic scale.

The desert, from Guerreros to the entrance to the gorge leading through the rocky hills which divide it from the plain of Arequipa, is upwards of forty miles across, while its length from the transverse valley of Tambo to that of Vitor must be about sixty. During the greater part of the day we were threading our way through arid mountain gorges, and up and down zigzag rocky paths strewn with the bones and carcasses of mules, under a scorching sun. A little pale purple *Nemophila*, a small *Crucifer*, and the weird *Cacti*, the appropriate inhabitants of the desert, are the only plants of this cheerless region; and a few obscene gallinazos, floating lazily in the upper air, with their keen-piercing eyes watching for some luckless mule to sink under its burden, were the sole representatives of animal life.

AREQUIPA.

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At length our eyes were gladdened by the sight of the green vale of Tiavaya, in the campiña of Arequipa. The rows of tall willows, the bright green fields of lucerne, and white farm-houses, were a blessed relief after the monotonous glare of barren rocks and sand; but it was not until late at night, and after a ride of more than fifty miles, that we reached our hospitable lodging in the city of Arequipa.

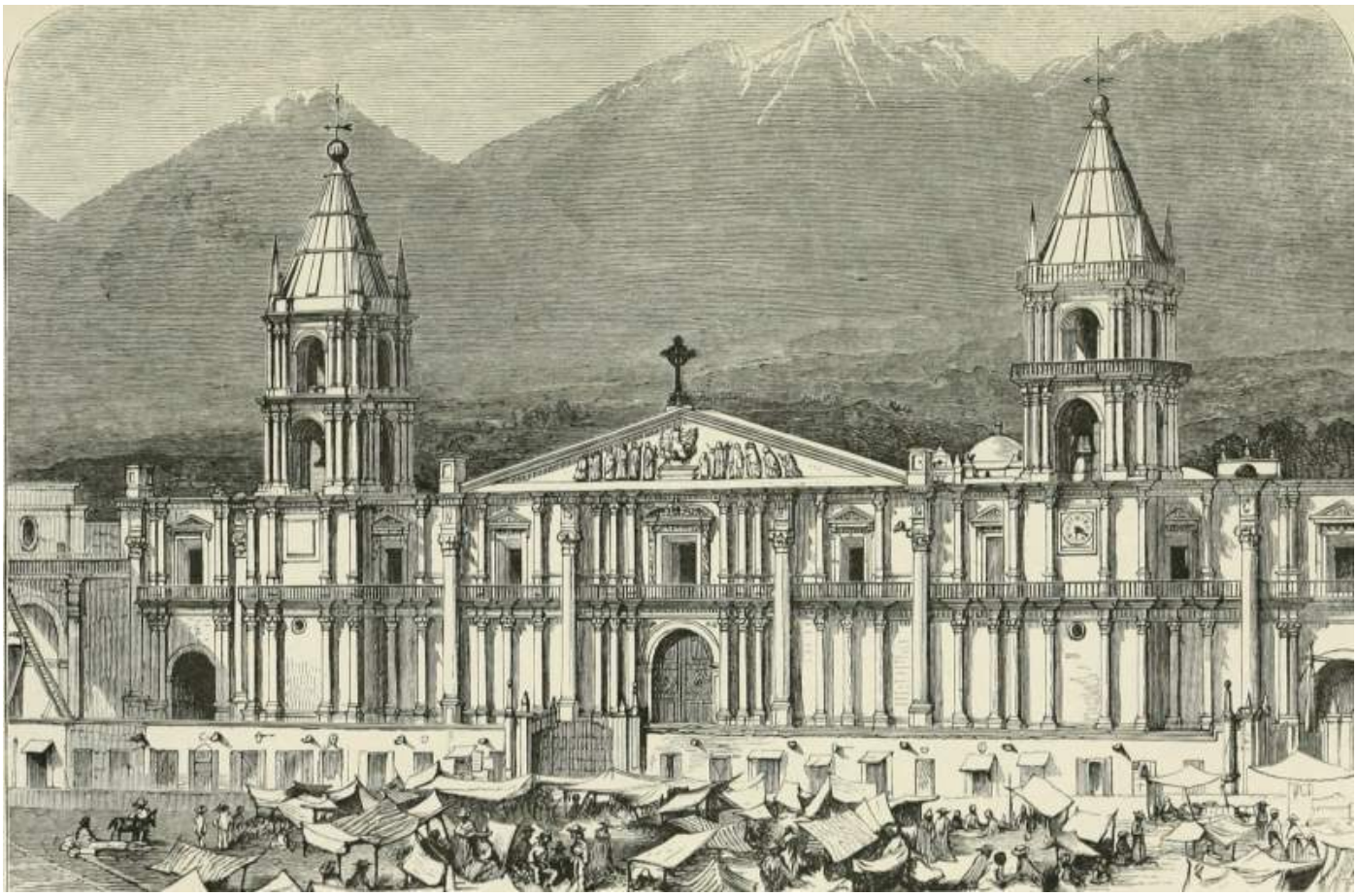
Arequipa, the second city in Peru, is built on the banks of the rapid river Chile, and at the foot of the great volcano, called Misti, which rises up in a perfect cone to the height of 17,934 feet, its upper half covered with snow. Arequipa itself is 7427 feet above the sea, so that the mountains ascend in one unbroken sweep upwards of 10,500 feet. The climate, during my stay from March 11th to March 22nd, was as follows:—

Mean temperature	64⅓
Mean minimum at night	60½
Highest observed	67
Lowest	58
Range	9

The town is built of a white stone of volcanic origin, being a trachytic tuffa containing pumice and lava, dug out of quarries at the foot of the volcano. The houses are usually of one story, built solidly and substantially, with vaulted stone ceilings, the better to

resist the shocks of the frequent earthquakes. Like almost all Spanish American cities, the streets are straight and at right angles to each other, with an *azequia* flowing down the centre. Wheeled vehicles of any description are unknown, and the traffic consists of horses, droves of mules, donkeys laden with lucerne, and flocks of llamas. The principal streets all lead to the great square, which forms a busy and most interesting scene in the morning, the time for marketing. It is then filled with gaily-dressed Indian women, some sitting under shades, with their goods spread out on the ground before them, and others, in constant movement, threading their way amongst the sellers. Their dresses are of baize, manufactured at Halifax,[123] of the gayest colours—consisting of a skirt and mantle of the two most brilliant colours they can find, red and blue, green and crimson, or purple and orange. The effect of these bright-coloured groups, in constant motion, as they move about buying fruit or vegetables, potatoes, earth-nuts, medicinal drugs, corn, articles of dress, and other necessaries, is very pleasing. The background is formed by the handsome new cathedral of whitest stone, behind which the noble volcano, and the peaks of Charcani (18,558 feet above the sea) dazzle the eyes by the brilliancy of their snowy covering.

The campiña of Arequipa, which surrounds the city, is about five miles broad from the foot of the cordillera to the arid range of hills which separates it from the wilderness of the coast; and about ten or twelve miles long, being bounded at each end by a sandy desert. It is watered by the river Chile,[124] coming from a chasm in the cordillera, on the north-west side of the volcano, and by the streams called Posterio and Savandia, which flow from the Pichu-pichu mountains to the eastward of the volcano. These several streams unite on leaving the campiña, and finally fall into the river of Quilca. The campiña contains, besides the city of Arequipa, a number of small villages, and numerous farm-houses. In March the view from the hills above the city is most beautiful. The brilliant green of the campiña, with its fields of maize and alfalfa, its rows of tall willows, and orchards of fruit-trees, is dotted with houses and villages, while it forms an emerald setting to the white city. Looking from the other side of Arequipa, the view, though not so beautiful, is more imposing: the snow-capped volcano rearing its majestic head above the stunted towers of the town. There is a great deal of maize grown in the valley, and guano is extensively used as manure; but the wealth of the campiña is chiefly derived from its mules, which monopolize the carrying-trade from the coast to Arequipa, and from Arequipa to the interior. A quantity of lucerne or *alfalfa* is raised for their sustenance, and the *arrieros* or muleteers are a wealthy class of men, generally possessing a *chacra* or farm of their own, besides considerable sums in ready money. They are, as a rule, good-looking, well-grown men, with fresh complexions, and little mixed blood, which is also made evident by the comparatively fair complexions of their wives and daughters.



AREQUIPA CATHEDRAL.

From a Photograph. Page 76.

The families of the upper classes of Arequipa usually own estates in the neighbouring warm valleys of the coast, such as Vitor, Tambo, Siguas, Majes, and Camana, where the rich vineyards yield them a profitable return by the sale of aguardiente. Their houses in the city are built round a *patio* or courtyard, on which the principal rooms open. Their sons are frequently the leaders of the turbulent *Cholos* in revolt, and follow the professions of *abogados*, lawyers or politicians, traders, and *haciendados* or farmers, while the more ambitious adopt a military life, the *carrera de armas*. The ladies are considered the most beautiful and intelligent in Peru, and, at Lima, the most attractive women are usually Arequipeñas. Perhaps the majority have never moved beyond the campiña, and adjacent warm valleys, and many have never seen the sea. Yet they are sprightly and agreeable in society, full of intelligent curiosity, and almost invariably excellent musicians. They frequently sing the plaintive *despedidas*, and other sonnets of their native poet Melgar, whose love for a fair townswoman was unrequited, and whose melancholy fate has surrounded his name with a halo of romance. He was barbarously shot, after having been taken prisoner by the Spaniards, at the battle of Umachiri in 1815, the first attempt which the Peruvians made for their independence.

During the winter months the wealthier families remove to villages in the campiña, either to Tingo, Tiavaya, or Savandia, taking furniture with them. At the commencement of the season droves of mules leave the city laden with beds, chairs, and tables, to render the country houses habitable. Here the Arequipeños enjoy the delights of the country and of bathing in large swimming-baths faced with masonry, and planted round with rows of tall willows. The rides in the country which surrounds these villages are exceedingly pretty. The trees consist chiefly of tall willows and of the *Schinus molle* with its bunches of red berries, while bushes of fragrant white *Daturas* and of the beautiful *Bignonia fulva* fill the hedges, and the streams are bordered by masses of *Nasturtiums*. The fields either bear crops of vivid green alfalfa, or tall Indian corn, six to eight feet high, over which the *Tropæolum canariensis* creeps in golden masses, and at whose feet the bright blue *lupins*, and a *Solanum* with rich purple flowers, grow as weeds. From many points of view the rapid waters of the river Chile complete the picture, while far away the snowy peaks of Chuquibamba, Charcani, and the volcano glisten in the beams of the sun. Above Arequipa the river flows through the valley of Chilinos, the steep sides of which are lined with *andeneria*, or terraced maize-gardens, with here and there a picturesque group of the stone huts of the Indians, often completely hidden by the dark green leaves and golden flowers of the gourds which cover them. The courtyards of the houses are frequently ornamented with a beautiful passion-flower, which creeps over the trellised verandahs, and is covered with flowers. It is a species of *Tacsonia*, called by the natives *tumbo*. The flower has a very long tube, and is of a deep rich rose-colour: and a delicious *fresco*, or sherbet, is made of the egg-shaped fruit.

In addition to the baths of pure spring-water at Tingo and Savandia, the medicinal baths of Yura are a great resort during the winter months. Yura is thirty miles to the north-west, and is situated, like Arequipa, just under the range of the cordilleras. The road leads over very broken ground, where the rugged spurs from the Andes project out into the desert. In March the weary arid wilderness was enlivened by wild flowers, bushes of yellow and purple *Solanums*, bright orange *Compositæ*, and, in one place, a carpet of little purple dwarf iris. The baths are in a green ravine, with tall willow-trees and maize-fields, watered by a little rivulet. In this narrow glen, bounded on one side by sandstone mountains, which here form the base of the volcano, and on the other by a ridge of trachyte, there are two places where thermal waters bubble out of the rocks, one being ferruginous and the other sulphurous. At the sulphurous baths there are some solid stone buildings, intended as lodgings for the bathers, with heavy arcades, and long vaulted rooms with no windows, and without furniture, for, as at Tingo and Savandia, all visitors bring their beds, tables, chairs, crockery, and cooking utensils with them. In the bath-room there are four square basins, faced with stone, of different temperatures, and called the *Vejeto* (87° Fahr.), the *Desague* (88°), the *Sepultura* (89°), and the *Tigre* (90°). They are said to cure dysentery, rheumatism, and cutaneous diseases. The rivulet

flows down the glen and joins the river of Yura near a village called Calera, where most of the soap is manufactured which is consumed in Arequipa. Great quantities of carbonate of soda are collected from the sandstone rock, which gives employment to the people of the village. The land is divided into *topos* (5000 square yards), each valued at a thousand dollars, and every six weeks a harvest of *salitre* (carbonate of soda) is reaped. From Calera there is a fine view of the green valley of Yura, and of a grand range of porphyritic mountains.

The population of the campiña and town of Arequipa is reckoned at about 50,000.[125] The place was first colonized by the Inca Mayta, who established a body of *mitimaes* or colonists there, from the village of Cavanilla, near Puno, and ordained that they should remain and settle there. Hence the name "*Ari quepay*," "Yes! remain:" or more probably it is derived from the words "*Aric quepa*," "Behind the sharp peak." These *mitimaes* were the ancestors of the present Indians, or *Cholos* as they are called, and were established in villages in the campiña, occupied in the cultivation of maize; but the city is purely Spanish, and was founded by Pizarro in 1540, at which time the stone-quarries first began to be worked.

The *Cholos* or Indians of Arequipa have long been notorious for their turbulence, and for the eagerness with which they join any attempt at revolution, apparently from mere love of excitement. They are addicted to the use of *chicha*—a fermented liquor made from Indian corn—to such an extent that it is said that nearly all the maize which is raised in the campiña is used in brewing this liquor; under the influence of which the Cholos have established the fame of Arequipa as the grand focus of Peruvian revolutions. But this habit of drinking to excess has rendered the Cholos, though capable of fighting desperately behind walls, quite worthless as soldiers in a campaign; and their habit of body becomes so bad that a slight wound is frequently fatal.

Though the received idea in Europe, that Peru is constantly in a state of civil war, is erroneous in fact, as well as unjust,[126] yet it is true that the period of tranquillity which had lasted from 1844 to 1854 was broken in the latter year by the successful revolution of General Castilla—the result of the discontent caused by the dishonest financial measures and the embezzlements of his predecessor; and two years afterwards the Cholos of Arequipa commenced a rebellion against Castilla. A brief account of the siege of that city, which followed, will give a good idea of the endurance and fighting qualities of the Cholos.

In October 1856 two young men of good family, named Gamio and Masias, collected a handful of Cholos, and sent a message to the Prefect Canseco, telling him that he must either evacuate the city with his troops, or lay down his arms. The prefect marched out, and left Arequipa in the hands of the insurgents, who proclaimed the exiled General Vivanco President of Peru, and appointed Don José Antonio Berenguel prefect of the town; and most of the soldiers who had marched out with Canseco returned on the

following day to join the rebels. Vivanco was an exile in Chile, but, on receiving the news, he started for Islay by the English mail steamer, and reached Arequipa in December; while General San Roman, who had been sent from Lima to propose terms of accommodation with the rebels, was dismissed, and retired into the interior to collect forces for the support of Castilla's government.

While the Cholos of Arequipa were maturing their rebellion, a fortunate event placed the Peruvian navy at the disposal of Vivanco. Their largest frigate, the 'Apurimac,' was lying off Arica, and, while her captain, a rough old Chilian seaman named Salcedo, was on shore, the crew, led by Lizardo Montero, one of her lieutenants, a young man and native of Piura, mutinied, declared for Vivanco, and steamed away, leaving Salcedo storming on the beach. The 'Apurimac' went at once to Islay, where Montero captured the port, and where he was joined by two smaller steamers, the 'Loa' and 'Tumbez.'

Vivanco, meanwhile, had proclaimed himself "Regenerator" of Peru, and offered his services as a lawgiver and restorer of prosperity to his country, which were not accepted or appreciated, as none of the other great towns followed the example of Arequipa. Leaving a ministry consisting of young inexperienced lawyers, who had nothing to lose and all to gain, in charge of affairs at Arequipa, he embarked on board the 'Apurimac,' in the end of December, 1856, and sailed for Callao, but did not venture to disembark. He then went on board the 'Loa,' leaving the 'Apurimac' to watch Callao, and proceeded to Truxillo; while the 'Apurimac' went down to the Chincha Islands, and began shipping off the guano to any one who would buy it, thus leaving the port of Callao open.

General Castilla is an old Indian, possessed of great military talent and extraordinary energy and intrepidity; while Vivanco is a native of Lima, of pure Spanish descent, indolent, dilatory, and without personal courage; but eloquent and persuasive, and possessed of qualities which have surrounded him with numerous warm partisans and personal friends. Between such men the issue could not be doubtful.

The veteran Castilla, as soon as the 'Apurimac' had sailed for the Chincha Islands, formed the daring plan of attacking his enemy in the north; and, in spite of the Navy, which had declared against him, he bought an old steamer, the 'Santiago,' belonging to the English Steam Navigation Company, and boldly steamed away in search of the Regenerator. On hearing of his approach, Vivanco was seized with a panic, and, evacuating the places he had occupied, retreated to his ships. He now thought that, in the absence of Castilla, he might succeed in an attempt on the capital, and, collecting all his vessels, he retraced his steps southward, and arrived in Callao bay on April 22nd, 1857. A night attack was then made on the fort, but, after some hard street fighting, Vivanco's party were obliged to retire to their ships; and, his expedition having proved a complete failure, the Regenerator returned to Islay, and proceeded at once to Arequipa.

While Vivanco was absent in the north, General San Roman had collected a considerable force in the interior, with which he marched towards Arequipa. The warlike Cholos came out to meet him, and a skirmish followed, which they call the battle of Yumina. It consisted of a considerable waste of powder, the two parties firing at each other, at very long ranges, across a ravine; and in the afternoon the Cholos returned in triumph to Arequipa. Having missed Vivanco in the north, old Don Ramon Castilla steamed away to Arica in the same old 'Santiago,' safely passing the rebellious fleet at Islay, collected a force at Tacna, and, marching by land, arrived in the campiña of Arequipa in the end of July; soon afterwards establishing his head-quarters at the village of Sachaca, some miles below the city, on the banks of the river Chile. A detachment occupied Tiavaya, to cut off Vivanco's communication with Islay.

The people of Arequipa were now hard at work to place the city in a proper state of defence; barricades were erected in the most important streets, and day and night the Cholos were under arms. But, supplies having now entirely ceased from the custom-house at Islay, Vivanco found himself in great difficulties; for people, having little faith in the success of his revolution, were unwilling to advance money in exchange for his *vales* or promissory notes, even at a discount of fifty per cent. The needy Regenerator then resorted to more violent methods of raising money, and, breaking open several of the principal shops, began to sell their contents to the highest bidder.

Castilla made constant sham attacks upon the town, which kept the inhabitants in a continual state of alarm; but all his supplies were derived from Arica, by way of Tacna, as the port of Islay remained in the hands of Vivanco's party. This was his weak point; and when the 'Apurimac' arrived off Arica, and her commander Montero, after a sharp street fight, got possession of that port in February, 1858, Castilla found himself in a position of great difficulty. His supplies were entirely cut off, and it became necessary for him to assault Arequipa at all hazards. Accordingly he moved from his quarters at Sachaca and Tiavaya, marched round the south side of the city, and early in the morning of March 5th, 1858, commenced an attack on the eastern suburbs. His troops first stormed the church of San Antonio, and then advanced to the attack of San Pedro, which had also been occupied by the besieged. Here the Cholos held their ground for four hours, from eight to twelve A.M., in spite of the desperate attacks of Castilla's best troops, and the well-directed fire of his artillery. At length, overpowered by numbers, they were forced to retire, disputing every inch of the ground. They rallied at the convent of Santa Rosa, and obstinately defended the position for several hours, until night closed in upon the combatants. Next morning, being the 7th of March, some further resistance was made, but the troops of Castilla finally stormed the barricades, and drove everything before them. Vivanco escaped in the disguise of a friar to Islay, and thence to Chile, while his officers looked after themselves, leaving the gallant defenders of Arequipa to their fate. Tacna and Arica at once returned to their allegiance, and the 'Apurimac' was given up to Castilla's ministers at Lima by the mutinous Montero.

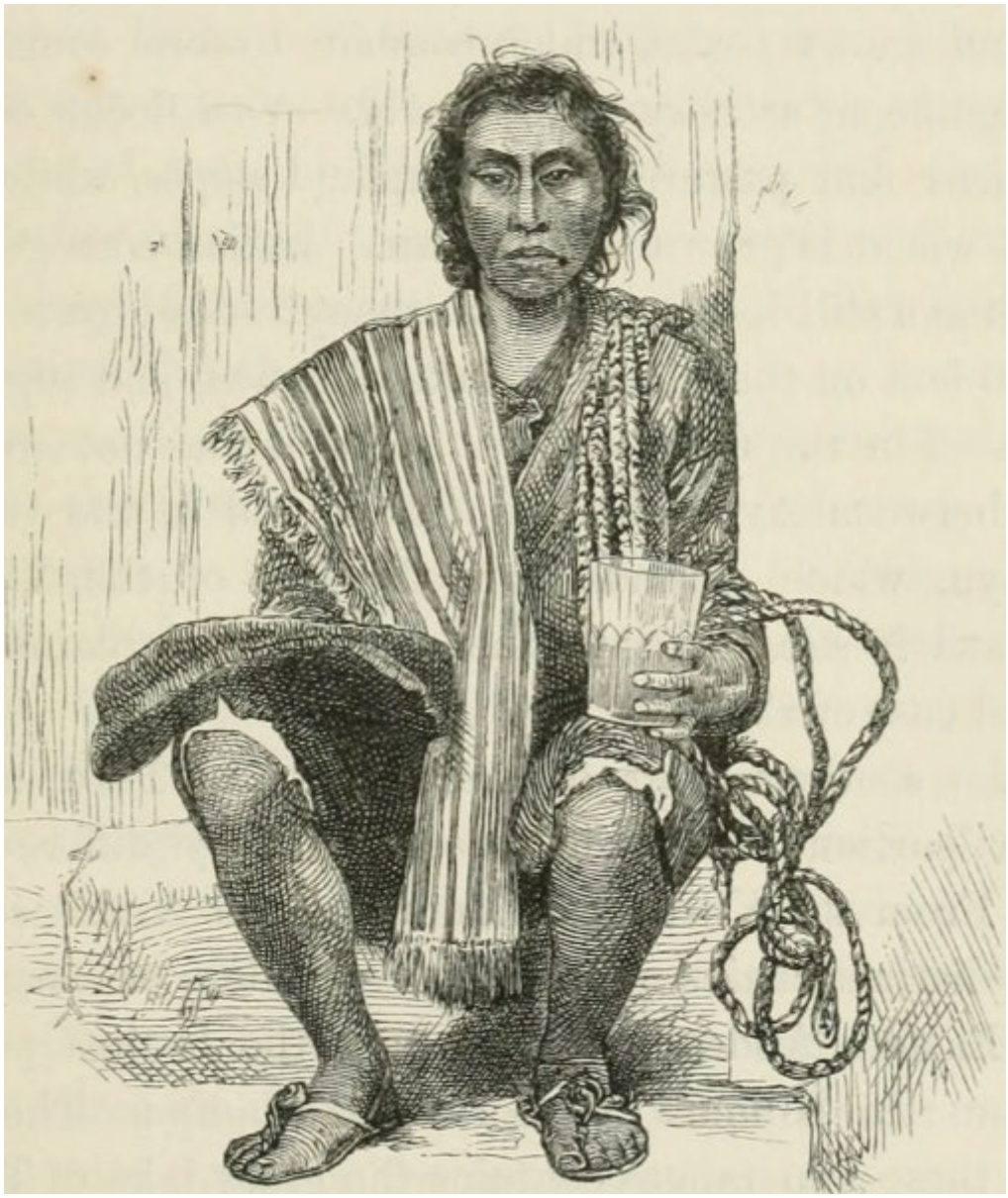
The Cholos of Arequipa thus defended their position, with great bravery and resolution, against Castilla's disciplined army for upwards of eight months; and during the assault, which lasted for two days, their desperate valour was as remarkable as their extraordinary endurance, for, such was the negligence of Vivanco and his officers, that they were kept without refreshment or even water during the many hours in which they sustained a deadly and unequal struggle against Castilla's troops. It should also be recorded to their credit, that, although the town was on several occasions entirely in their hands, there was no instance of any act of pillage or excess being committed by them; and, when all authority was withdrawn, they showed no disposition to take advantage of their power, but displayed a regard for order which would not be found among the lower orders of most other countries during periods of great excitement.

There is a very striking difference, however, between the Cholos of Arequipa and the Inca Indians of the interior, who appear in the streets with their llamas laden with silky vicuña-wool: the former a turbulent, excitable race, who will fight desperately behind walls, but who are without stamina and quite unable to endure fatigue; the latter a patient, long-suffering people, capable of extraordinary endurance, and, as soldiers, in the habit of marching distances which appear incredible to those whose experience is confined to the movements of European troops. There is an evident mixture of Spanish blood in the people who inhabit Arequipa and its campiña, while the Indians of the interior are for the most part of pure descent.

The road over the cordilleras to Cuzco and Puno leaves Arequipa by the southern suburb, and, after a few miles, ascends a rocky ridge to the more elevated valley of Chihuata or Cangallo (9676 feet above the sea[127]), at the foot of the southern spur of the volcano. A wretched stone hut with a mud floor is here the only shelter for the traveller. At one end a fire of sticks, where an old hag acted as cook, filled the interior with smoke, and at the other each wayfarer, as he arrived, made a shakedown of blankets and ponchos, sipped his chocolate, and, after a short conversation, composed himself for the night. The fire gradually smouldered and went out, and the old woman, with a brood of children, made a heap at the further corner.

At early dawn of the 23rd of March we were all in motion, and our companion of the previous night, a Spaniard with a large *tropa* of mules laden with aguardiente, was busily preparing for a start. As the sun rose, the dazzling white of the snowy peaks of Pichu-pichu and the volcano, with fleecy clouds above their summits, gave a glorious effect. The rest of the sky was blue, gradually clouding over as the morning advanced; and the valley was covered with alfalfa-fields of the richest green, with the pretty little village of Cachimarca perched on a rounded hill to the southward. The flowering shrubs by the roadside are the same as in the campiña of Arequipa, except that a small yellow Calceolaria is more abundant. The morning air was fresh and bracing as we mounted our mules and faced the long zigzag path up the "alto de los huesos," the southern spur of

the volcano, so called from the bones of thousands of mules which are met at every turn. This ascent conducts the traveller from the temperate valley of Cangallo to the bleak and chilling plains of the upper cordillera.



A CHOLO OF AREQUIPA.

From a Photograph. See page 80.

CHAPTER VI.

JOURNEY ACROSS THE CORDILLERA TO PUNO.

In the region of the cordillera of the Andes, in Northern and Central Peru, the country is broken up into deep warm valleys and profound ravines, separated by lofty precipitous ridges and snowy peaks, which combine to form some of the most magnificent scenery in the world. Vast flocks of sheep and alpacas find pasture on the upland slopes, while abundance of wheat is grown lower down. Indian corn generally flourishes at a still lower elevation, though it is grown as high as 13,000 feet on the islands of lake Titicaca, and sugar-cane is cultivated in the deep valleys. This is the nature of the country between Ayacucho and Cuzco, and in the valley of Vilcamayu, which extends from the foot of the Vilcañota range until it subsides into the vast tropical plains to the north and east of Cuzco.

But the southern part of the interior of Peru, and the northern portion of Bolivia, present a very different character. From the Vilcañota mountains the Andes separate into two distinct chains, namely, the cordillera or coast-range, and the Eastern Andes, which include the loftiest peaks in South America, Illimani and Sorata, or Illampu. The region between these two ranges contains the great lake of Titicaca, and consists of elevated plains intersected by rivers flowing into the lake, at a height never less than 12,000 feet above the sea. The magnificent scenery of Northern and Central Peru is wanting in this southern part of the country, which composes the department of Puno, and is usually called the *Collao*. It, however, possesses features of its own which are at once striking and imposing, while the land which is drained by the lake of Titicaca was the cradle of the civilization of the Incas.

The journey up the "Alto de los huesos" is very fatiguing, and the change from the pleasant exhilarating air of Chihuata, to the chilling icy blasts which constantly sweep over the upper region of the cordillera, was severely felt. As the afternoon advanced a drizzling mist came on, and added to the cheerless desolation of the plains it was necessary to traverse before reaching the post-house of Apo. Occasionally a drove of llamas, with their Indian driver, loomed for a moment through the mist, and at nightfall we arrived at the post-house of Apo (14,350 feet), tired, drenched, and cold.

The rainy season of the cordilleras commences in November, and continues until the end of March, and during most of that time the discomfort of travelling is so great, and the rivers so swollen, that a journey is seldom undertaken by an ordinary traveller. In March, however, the rain does not fall continuously or in any quantity. The early morning is generally clear, but in the afternoon mists, rain, or snow begin to fall, and

continue until far into the night. From April until October is the dry season, and in May, June, July, and August a cloud is scarcely ever seen in the sky.

The post-houses in the desolate mountains between Arequipa and Puno are all of the same character. They consist of a range of low stone buildings surrounding a courtyard on three sides, and consisting of five or six rooms with mud floors, a rough table, and a platform of stone and mud at one end, which is intended for a bed-place. The roof is badly tiled or thatched, and the doors are so roughly fitted that it is impossible to close them. Both man and beast are subject to a most distressing illness, caused by the rarefaction of the air at these great altitudes, which is called *sorochi* by the Peruvians. I had suffered from a sharp attack of illness at Arequipa, so that I was probably predisposed to a visitation from *sorochi*, which I certainly endured to its fullest extent. Before arriving at Apo, a violent pressure on the head, accompanied by acute pain, and aches in the back of the neck, caused great discomfort, and these symptoms increased in intensity during the night at the Apo post-house, so that at three A.M., when we recommenced our journey, I was unable to mount my mule without assistance.

A ride of seven hours across grassy plains covered with herbage, with patches of snow here and there, and ranges of hills with fine masses of rocks, forming a setting to the distant peaks of the cordillera, brought us to the post-house of Pati. During this ride we had to ford the river, which flows past Arequipa as the Chile, more than a dozen times. The only living creatures are the *lecca-leccas*, a bird which frequents the numerous streams, and the graceful flocks of vicuñas. The *lecca-lecca* is a large plover, with red legs, white head, grey body, white under the breast and tail, and wings and tail broadly edged with black. It incessantly utters a wild shrill scream. The vicuñas, a species of llama with the habits of an antelope, are very beautiful and graceful creatures. They have rich fawn-coloured coats, with patches of white across the shoulders and inside the legs, and long slender necks. They are constantly met with in the most desolate parts of the cordillera, browsing on the tender shoots of the tufts of *ychu*, or galloping along with their noses close to the ground, as if they were scenting out the best pasture.

At Pati a range of abrupt porphyritic cliffs rises from the plain, up which a rough zigzag pass leads to the "Pampa de Confital,"[128] the loftiest part of the road over this pass of the cordillera. A storm of hail began to fall, which turned into snow as we reached the pampa, and a ride of many hours over a succession of wild desolate plains, in an incessant snow-storm, brought us to the "alto de Toledo," the highest part of the road, and 15,590 feet above the level of the sea.[129] Some glorious snowy peaks appeared through the gloom at sunset, and after several weary hours in the darkness we at length arrived at the post-house of Cuevillas.

In the neighbourhood of Cuevillas there are large sheep-farms, one called Toroya, near the "alto de Toledo," and another called Tincopalca farther on. The sheep, at this enormous height, lamb in March and July, and, of the March lambs, usually about fifty

per cent. survive. Beyond Cuevillas there are two large Alpine lakes, whence a river flows down into Titicaca, and we thus passed the watershed between the Pacific and the great lake. The scenery is grand and desolate, reminding me, in some respects, of the interior of Cornwallis Island in the Arctic regions. The road passes between the two lakes, and we reached the post-house of La Compuerta as the afternoon rain commenced. The hills are covered with tufts of coarse grass (*Stipa ychu*), of which the llamas eat the upper blades, while the sheep browse on the tender shoots underneath; and with two kinds of shrubby plants, one a thorny *composita* called *ccanlli*, and the other called *tola* or *ccapo*, which is a resinous *Baccharis*,[130] and is used for fuel.[131]

The gorge in which the La Compuerta post-house is situated is the only outlet for the waters of the lake. Mountains of great height rise up on either side, clothed, at this season, with herbage of the richest green, while ridges of scarped cliffs of dark porphyritic rock crop out at intervals. The river dashes noisily over huge boulders, and near its left bank are the rough stone buildings of the post-house. Great quantities of ducks, gulls, coots, godwits, and sandpipers frequent the shores of the lake. The postmaster supplied *alfalfa* for the mules, and a *chupé* consisting of potatoes and salt mutton for the travellers, at exorbitant prices; the mules were freed from their cargoes, which were placed within the porch, ready lashed up in their *redecillas* or hide nets; and we were soon rolled up in blankets and ponchos, while the snow continued to fall unceasingly through the early part of the night. When we got up next morning the thermometer was at 31° Fahr. indoors.

Starting at dawn, we descended the gorge, passing two ruined mining establishments, San Ramon and Santa Lucia, into green plains with large flocks of sheep scattered over them.

In these uninhabited wilds it is an event to meet a traveller, and his appearance is the signal for a succession of questions and answers. We here passed a *cavallero*, in whose dress and general appearance we saw a reflection of our own, excepting the comforters. He wore a large poncho of bright colours, reaching nearly to his heels; a broad-brimmed felt hat with a blue cotton handkerchief passed over it, and tied in a knot under his chin; an immense woollen comforter passed round his throat and face, until nothing appeared but his eyes; a pair of woollen gaiters, bright green, with black stripes; and huge spurs. He was an officer on his way to Arequipa, and complained of the severity of the weather and the heaviness of the roads. After a short conversation the traveller passed on, followed by his cargo-mules, and soon became a speck in the distance.

In the afternoon we came to the first signs of cultivation, since leaving the valley of Cangallo, in the neighbourhood of the great sheep-farm of Taya-taya—patches of quinoa, barley, and potatoes, with the huts of Indians scattered amongst them; and, crossing a rocky ridge, we came in sight of a vast swampy plain, with the little town of Vilque, at the foot of a fine rocky height, in the far distance, which we reached at sunset.

The long rows of thatched brown huts dripping with rain, and the muddy streets, looked melancholy. But at the time of the great fair, in June, Vilque presents a very different appearance. The plains, for several miles beyond this little town, were so swampy as to be rendered almost impassable. It was with the greatest difficulty that we made our way across them, constantly wading and splashing through water, and in some places sinking so deep in the adhesive mud, that it was not without desperate exertions that the mules could extricate themselves. At length we came to a rocky ridge which bounded the vast pampa of Vilque, and continued our journey over rather drier ground.

Since leaving La Compuerta we had been continually descending; the vicuñas had disappeared, as they confine themselves to the loftiest and wildest parts of the cordillera; but, in the lower region between Vilque and Puno, the feeling of desolation and solitude is dissipated by the numbers of birds which enliven the country, and by the increased quantity and variety of wild flowers.

The *lecca-leccas* or plovers were very numerous, screaming shrilly as they flew in circles, or ran along the ground. In the clefts of the rocks there were many birds, like creepers, called *haccacllo* by the Indians, and *pito* in Spanish—beaks curved downwards, black on the top of the head, white underneath, red at the back of the neck, speckled wings, white breast, and a black line from the beak to the back of the neck. We also saw many small green paroquets, bright yellow finches called *silgaritos*, a kind of partridge called *yutu*, and, above all, the glorious *coraquenque* or *alcamari*, the royal bird of the Incas, whose black and white wing-feathers surmounted the imperial *llautu* or fringe of the sovereigns of Peru. The *alcamari* is a large and noble-looking bird of prey, with a scarlet head, black body, and long wing-feathers of spotless white. Wherever the plains are intersected by ridges of rocky cliffs, which is frequently the case, there are swarms of large rodents, called *biscaches*, which sat on their hind legs, and looked about inquisitively as we rode past.

Riding over several wide grassy plains, and passing the village of Tiquillaca, we arrived at the banks of the river Tortorani, which was so swollen as to be quite impassable. By following its course for about half a mile, we came to a place where the whole volume of water precipitates itself down a sheer declivity of 250 feet, and forms a magnificent cascade. A league below the falls we found a bridge, and, at sunset, we came in sight of the great lake of Titicaca, with the snowy range beyond. A steep zigzag descent leads down to the city of Puno, which is close to the shores of the lake, and hemmed in by an amphitheatre of argentiferous mountains.

Puno, the capital of the department, owes its origin and former prosperity to the rich veins of silver-ore in the surrounding country. It is approached, from the north, by a stone archway built over the road by General Deustua, who was prefect in 1850; and the streets slope by a gradual descent towards the lake. The houses are built of small-sized brown *adobes*, with roofs of thatch or red tiles, and courtyards very neatly paved

with round pebbles and llama's knuckle-bones in patterns. There are scarcely any with more than a ground-floor, and the rooms open on to the court; but, though at this elevation, 12,874 feet above the sea, it is extremely cold at night, stoves are unknown; and the unusual luxury of a fireplace, which exists in one house, is merely a luxury to the eye, for it is never lighted. The streets are clean and well paved, and the stone church in the *Plaza*, dating from 1757, has an elaborately carved front and two towers. In another plaza is the college, a large building with an upper story, also built by General Deustua; and both these public squares have bronze fountains erected by the Government of General Echenique, the late President, besides drinking fountains in the corners of several of the streets. The water is excellent.

Puno is surrounded by heights covered with patches of potatoes, barley, and quinoa (*Chenopodium quinoa*), the huts of Indians being interspersed amongst them; and immediately over the town there is an isolated rocky ridge of carboniferous limestone perforated by several natural caverns, called the Huassa-pata. The shores of the lake are a few hundred yards from the town, and at the little port there are always a number of balsas, made of large bundles of reeds tied together, with a reed sail.[132] The view to seaward is, however, confined by the peninsula of Capachica, and two islands at the mouth of the bay of Puno. A canal to enable balsas to come up nearer the town was made by the Spanish Intendente Gonzalez Montoya in the beginning of the present century.[133]

The flora of a country which, though within the tropics, is at an elevation of nearly thirteen thousand feet above the sea, must necessarily be meagre, and the few plants are lowly and inconspicuous. I noticed the following in the immediate vicinity of Puno. The only tree was one of stunted growth, with a pretty pink and white flower, and dark-green leaves, almost white underneath, called "oliva silvestre" by the Spaniards, and *ccolli* in Quichua (*Buddlea coriacea*); and of these there were not more than a dozen, sheltered behind walls. By far the greater number of plants are *Compositæ*: of these I observed three species of *Tagetes*—one with a small yellow flower; another very sweet, called by the Indians *huaccatay* and *chicchipa*, and used to flavour their chupes; and a large shrubby marygold, called *sunchu*;[134] also the common sow-thistle, a *Hieracium*, and the *tola* and *ccanlli* before mentioned, used for fuel. I found two Verbenas and a Solanum, all with purple flowers; a clover, a creeping cucurbitaceous plant, two Cacti, a large dock, three Geraniums, all with pink flowers; three Crucifers, very small herbs, one with a white flower, one with a yellow flower, and the third the common shepherd's-purse; a Gilium with a minute white flower, a small legume with tomentose leaves, a pretty little creeping Adoxa, a Statice, a wild Chenopodium, a Veronica, a minute Stellaria, a Rhinanthus, a mallow, a plantago, and three species of wild Oxalis, two very minute with white flowers, and one with a yellow flower. There were also two ferns, one a very beautiful Gymnogramma with silvery fronds; nine grasses, the

most abundant of which was the coarse *Stipa ychu*; and a few mosses. On the shores of lake Titicaca I saw rushes in great quantities, a Mimulus, a Ranunculus, a Rumex, and three grasses. These plants, though lowly and unpretending, are in sufficient abundance to cover the country with verdure and pretty wild flowers, and brighten those parts which are not cultivated. The cultivation consists of quinoa, cañahua (both *Chenopodia*), barley, potatos, ocas (*Oxalis tuberosa*), and wheat in very small quantities, which does not ripen.

Close to Puno, on the south, are the famous silver-bearing mountains of Cancharani and Laycaycota, to which Puno owes her existence: and to the discovery and working of the Laycaycota mine in the middle of the seventeenth century a very curious history is attached; which is always talked of by the people of Puno as one of the principal events in the annals of their city.

In about 1660 an exceedingly rich vein of silver had been discovered on the hill of Laycaycota, by one José de Salcedo, which was called the "Veta de la Candelaria." One account says that the secret of its existence was revealed to Salcedo by an Indian girl. José de Salcedo, and his brother Gaspar, continued to work this vein, and several others which were opened on the Cancharani and Laycaycota hills; enormous quantities of silver were extracted; and the fame of his enormous wealth, and its source, attracted crowds of unruly people to the spot, from the various towns of Peru.[135] Salcedo is said to have been generous and open-handed in finding employment for applicants, but, from some unexplained cause, tumults took place at the mines in 1665, which, from first to last, are said to have caused 450 violent deaths. The governor of the district, Don Angelo de Peredo, seems to have taken part against the Salcedos, who retired to the village of Juliaca, with a body of armed followers, in November, 1665. In March, 1666, they attacked the governor's people who had possession of the mines; Salcedo neglected repeated orders to come to Lima; and was accused of having threatened to extort a general pardon from the Viceroy, at the head of a thousand men. Salcedo himself, however, appears to have been absent at Cuzco when the attack was made on the mines. These tumults, accompanied by much bloodshed, continued until 1669, when the Viceroy Count of Lemos came to Puno in person, and settled the question by sending José and Gaspar de Salcedo to Lima, where José was tried, condemned, and executed. Gaspar was detained a prisoner in Callao castle.

It was the general impression at the time, and is so still at Puno, that jealousy and envy of their riches occasioned the persecution of these men; for not only were the charges against them most frivolous, but the Count of Santistevan, the predecessor of the Count of Lemos, had caused the Bishop of Arequipa to publish a general pardon of all offences in 1666. The accusations against José Salcedo were that he went about with armed men, took a seat next to the corregidor at a bull-fight in Cuzco, and neglected to obey the order to come to Lima.[136]

A petition was afterwards sent to Spain, representing that the Salcedos were the victims of injustice, and not guilty of disloyalty; that the Viceroy's proceedings were irregular; and that the heirs of the Count of Lemos were bound to make reparation for the evils caused to these deserving men. The petition also prayed that the President of the Council of the Indies might not be allowed to decide the case, because he was related to the Count of Lemos.[137] This petition seems to have received favourable consideration; for I find that the son of José de Salcedo was afterwards created Marquis de la Villa Rica de Puno, and that he took a leading part in subsequent mining operations.

The most remarkable part of this story is that on the day of Salcedo's death the mine became full of water, and the Viceroy was thus disappointed in his expectation of succeeding to the wealth of which he had deprived his victim. This curious coincidence made a great impression on the Indians, which is not yet effaced; and they still point out a small lake or pond that is said to cover the once rich vein or "Veta de la Candelaria."

Salcedo's son, the Marquis of Villa Rica, attempted to reach his father's source of wealth by cutting a horizontal adit or *socabon* in the side of the hill looking on lake Titicaca; and he is said to have penetrated nearly 700 yards, and within sixty yards of his father's perpendicular shaft; but his funds failed him, and he died mad. In spite, however, of the filling up of the "Candelaria," great numbers of other shafts were sunk, and much silver was extracted, both by the Marquis, and by other speculators. A report, dated 1718, mentions as many as forty-six shafts on the hills near Puno, which were then being worked.[138] In 1740 a native company attempted to finish the *socabon* which had been commenced by the Marquis, but their workmen were unable to cut through the masses of porphyry, and, after vast expense, it was abandoned a second time.

From 1775 to 1824 the mines near Puno yielded ores worth 1,786,000 marcs of silver, at seven to nine dollars the marc; the richest year being 1802, when the yield was 52,000 marcs; but since 1816 it has been steadily decreasing, and in 1824, the year after the expulsion of the Spaniards, it had sunk very low. In 1826 the *manto* mine, to which the socabon leads, which was excavated by the Marquis of Villa Rica, was granted to General O'Brien, a gallant and enthusiastic old Irish hero of South American independence, who resumed the work, but without any success. Mr. Begg, an enterprising English merchant, undertook the completion of the *socabon* in 1830. He imported expensive machinery from England, employed an intelligent engineer named Patterson, and continued to work the *manto* mine until 1839. He built himself a house furnished with every English comfort, and lived in very good style; but the speculation was a failure, and he left the country a poor man in 1840, and died in Chile. After the departure of Mr. Begg, some Peruvian speculators continued to work at the same mine, but without any energy; and, at the time of M. de Castelnau's visit in 1845, only thirty workmen were employed.[139] When Lieut. Gibbon, U.S.N., passed through Puno in

1851, the *manto* was still being worked, but at the time of my visit it had been entirely abandoned since 1858.

It is one of the great evils arising from the political condition of Peru since the independence that there is a complete want of confidence in each other amongst the moneyed classes, and an absence, to a great extent, of the spirit of enterprise; so that any combination on a large scale for mining, or other purposes of a similar nature, is almost impossible. Peru is still a very young country, and there is reason to hope that this state of things will not continue; but now a feeling of suspicion, added to a want of energy, prevents the formation of native companies. Thus the *manto* is abandoned, and the numerous mines which once covered the hills of Cancharani and Laycaycota, and actually created the city of Puno, which nestles at their feet, are not worked. At present there is only one small mine at work, high up on the hill of Cancharani, called the Cachi Vieja. Its proprietor, Don Manuel Ferrandis, is an upright, intelligent, and most kind-hearted old gentleman, who has had much experience in mining operations; and on the 29th of March he took me to visit the abandoned *manto*, and his own works at Cachi Vieja.

About two miles south of Puno is the establishment built by Mr. Begg, at the foot of the Laycaycota mountain, and facing the lake. The buildings stand round a long courtyard, containing four trees of the *oliva silvestre*, probably, as the only trees in the country, once carefully tended by the former English residents. There is a steam-engine which turns a large stone wheel, twelve feet in diameter, for grinding the ores; and the quicksilver was separated by the heat of fires of llama-dung and *tola*,[140] the only fuel to be had. In the house there were papered rooms, fire-grates, and English conveniences, now all in ruins, and the rooms used as stables for donkeys. At a short distance from Mr. Begg's ruined house, and a little higher up the mountain, is the entrance to the famous "*Socabon de Vera Cruz*" of the *manto* mine, commenced by the Marquis of Villa Rica, and finished by Mr. Begg. The "*socabon*" penetrates into the mountain, in a generally south-west direction, for a distance of a mile and a quarter; the first 900 yards having a depth of some feet of water, which is dammed up at a little distance outside the entrance. This part of the gallery is navigated by an iron canoe about a foot and a half wide; but the canal is so narrow that the canoe frequently grates on both sides at once against the rocks. The roof of the excavation, too, is very low, and several times we actually had to crouch down in the bottom of the canoe, to avoid knocking our heads. Thus we penetrated into the bowels of the earth by this subterranean navigation, with an Indian holding a burning torch in the bows. From the entrance, for about 300 yards, the excavation traverses a mass of grey porphyry. In the 900 yards of navigation there are six locks; and when the water terminates, the gallery continues for a hundred yards, where there is an iron tramway laid down. The metal was dragged down to the head of navigation in cars, by two old mules, one of which had not seen daylight for fifteen years when they ceased to work the mine. At the point

where the tramway comes to an end, the gallery still continues for 1200 yards; but this part is very narrow and tortuous, and the metal was carried down to the cars on the backs of Indians. The rock at the extreme end of the excavation is a very hard green porphyry, with quartz and veins of silver ore.

The Cachi Vieja works are high up on the Laycaycota hill, and not far from the famous "Veta de la Candelaria." The mouth of the shaft is in a building opening on a courtyard, where women were sorting the ores in small heaps. The most abundant ore is called *brosa*, containing forty marcs of silver in the cajon of fifty quintals (cwts.); other ores are called *rosicler*, *pavonado*, and *polvarilla*. The *rosicler*, or ruby silver, is a most beautiful rose-coloured mineral, containing a considerable quantity of silver.[141]

Besides Cachi Vieja in the immediate vicinity of Puno, there are some very productive silver-mines at San Antonio de Esquilache, twenty miles south-west of that town, which have been worked since 1847 by Don Manuel Costas, one of the most influential citizens of Puno, and my host during my stay in that city.

Wool and silver are the great staple products of the department of Puno; the whole value of exported articles being about 1,200,000 dollars.[142] The population is rather under 300,000 souls; that of the town of Puno 9000.[143] Upwards of 1,500,000 dollars come into the department yearly, either in payments for wool, or in salaries for officials, without counting the expenditure for the troops; and it is calculated that more than half this sum eventually finds its way into the hands of the Indians, who bury it. Thus, in considering the mineral wealth of Peru, the enormous quantities of coined money, and vases or other articles made of the precious metals, which have been buried by the Indians, must be taken into consideration; for this practice has been going on since the time of the Incas. Now that the currency consists almost entirely of the debased half-dollars of Bolivia, if a Spanish dollar or any other good coin is accidently received by an Indian, it is immediately buried.

The principal people in Puno, during my visit, were General San Roman, in command of the army of the South, an old man with the face and head of a pure Indian, and plenty of white hair brushed off his forehead, who has been mixed up in all the wars since 1822, and from whom I received much information respecting the Indian rebellion of Tupac Amaru in 1780, and of Pumacagua in 1815; Señor Garces, the Prefect; Don Juan Francisco Oviedo; Don Manuel Costas; and Don Manuel Ferrandis, the proprietor of the mine on the Laycaycota hill. Every evening there was a party assembled at the house of the latter to drink coffee, and talk over the news of the day. On these occasions, amongst other topics of conversation, the possibility of forming a company for the navigation of lake Titicaca was frequently discussed. Costas had first been struck by the immense good that steam navigation on the lake would bring to the department of Puno in 1840, and in 1846 he purchased a small steamer called the 'Titicaca,' and had her sent out in pieces. He sold her to the Government, on condition that they would defray the

expense of sending her up to the lake; but this was never done. It is considered that any steamers which may hereafter be ordered for this purpose should be about forty tons, drawing four and a half feet, with paddles (as a screw would inevitably foul amongst the rushes), and accommodation for passengers on deck. They would take all the products of the Bolivian forests, bark, timber, chocolate, coca, fruit, and arnotto, to Puno; European manufactured goods, sugar of Abancay, and aguardiente of the coast, from Puno to Bolivia; provisions and traffic of all kinds amongst the Indians of the shores; and copper of Coracora to Puno. Timber in vast quantities might be felled in the forests of Caravaya, and floated down the rivers of Azangaro and Ramiz during the rainy season, which, with the coal on the island of Soto, would furnish supplies of fuel. Markets and easy means of communication having been formed, the trade would rapidly increase on all sides. The face of the country would be entirely changed; the people, finding new wants, would become more civilised; and Puno, instead of a city with empty silent streets, and half a dozen balsas at its anchorage, would be a flourishing and busy port.[144] These bright prospects, however, will require time, and a total change in the political condition of Peru, for their realization in a somewhat distant future.

It is also a very important question whether larches, firs, and birch-trees might not be naturalized in the more sheltered ravines of these lofty treeless regions; where large plantations might be formed for the supply of timber and fuel. The Indians are now entirely dependent, for the framework of their roofs, on the crooked poles of the *queñua* tree (*Polylepis tomentella*); and for fuel on llama's dung and the *tola* shrubs (*Baccharis*). The winters, from May to September, are not nearly so cold as in Scotland, though very dry; and, during the summer or rainy season, though it is cold, there is plenty of moisture. The introduction of these plantations would change the whole face of the country, and the introducer would confer an inestimable blessing on the inhabitants.

I remained for some time at Puno, in order to collect information, and come to a determination respecting the best course to pursue in the performance of the service on which I was employed. The supply of the bark of *Chinchona Calisaya* trees is now entirely procured from the forests of Munecas, Apollobamba, Yuracares, Larecaja, Inquisivi, Ayopaya, and the *yungus* of La Paz in Bolivia; but I found that the difficulties in the way of making a collection of plants and seeds in these districts would be very great, and it afterwards turned out that these difficulties would have been insurmountable. As a considerable part of the revenue of Bolivia is derived from the bark trade, which is not the case in Peru, the Bolivians are exceedingly jealous of their monopoly; and the nature of my mission was already suspected. Moreover there was an imminent prospect of a war between Peru and Bolivia; a large army was massed in three divisions—at Puno under General San Roman, at Vilque under Beltran, and at Lampa under Frisancho; and, as soon as hostilities commenced, it would have been next to impossible for a private person to preserve his mules from seizure. This war did not

actually take place, but Linares, the President of Bolivia, issued a decree on May 14th prohibiting all traffic, or the passage of travellers, from one country to the other;[145] a decree which was strictly enforced, and which would have rendered it impracticable at that time to have conveyed myself and companion, with laden mules, from Bolivia to the coast, without long delays and detentions. One of the pretexts for this threatened war is perhaps the most extraordinary that has ever been alleged in modern times; namely, that the Bolivian Government persisted in coining and deluging Peru with debased half-dollars. A strange way of settling a financial difficulty!

While these objections weighed against an attempt to collect plants in the forests of Bolivia, I found that, with regard to the chinchona forests of the Peruvian province of Caravaya, on the frontier of Peru and Bolivia, the facilities for such an enterprise would be much greater. I had reason to believe, though I afterwards found myself in error, that, as there was no bark trade in Peru of any importance,[146] no jealousy would be felt at the nature of my mission. Any hostile proceedings on the Bolivian frontier would not materially affect the route between the Caravaya forests and the coast; and, above all, Caravaya is much nearer and more accessible, as regards an available seaport, than any part of the chinchona forests of Bolivia. This latter point was of the very greatest importance, because success depended chiefly on the rapidity with which the plants could be conveyed across the frozen plains of the cordilleras. I knew from Dr. Weddell that, though the bark trade from Caravaya has now ceased, and bark from that district is of no market value, owing to a foolish habit of adulteration amongst speculators in former times, yet that young plants, and trees bearing fruit, of the *Chinchona Calisaya*, and other valuable species, were abundant in the forests of that province, as far north as the valley of Sandia.

I, therefore, after much anxious consideration, determined to proceed direct from Puno to the forests of Caravaya.

During my stay at Puno I had opportunities of examining some interesting ruins, and of collecting information respecting the Indian population of Peru, especially with regard to the great insurrections of Tupac Amaru and Pumacagua in 1780 and 1815. Much of this information is quite new; and I, therefore, trust that a description of ancient ruins near Puno, and an account of some of the most stirring events connected with the Indians since the Spanish conquest, may prove of sufficient general interest to justify a halt on the road to the chinchona forests, and a brief digression from the principal subject of the present work.

BALSA ON LAKE TITICACA.

See page 95.

CHAPTER VII.

LAKE TITICACA.

The Aymara Indians—Their antiquities—Tiahuanaco—Coati—Sillustani—Copacabana.

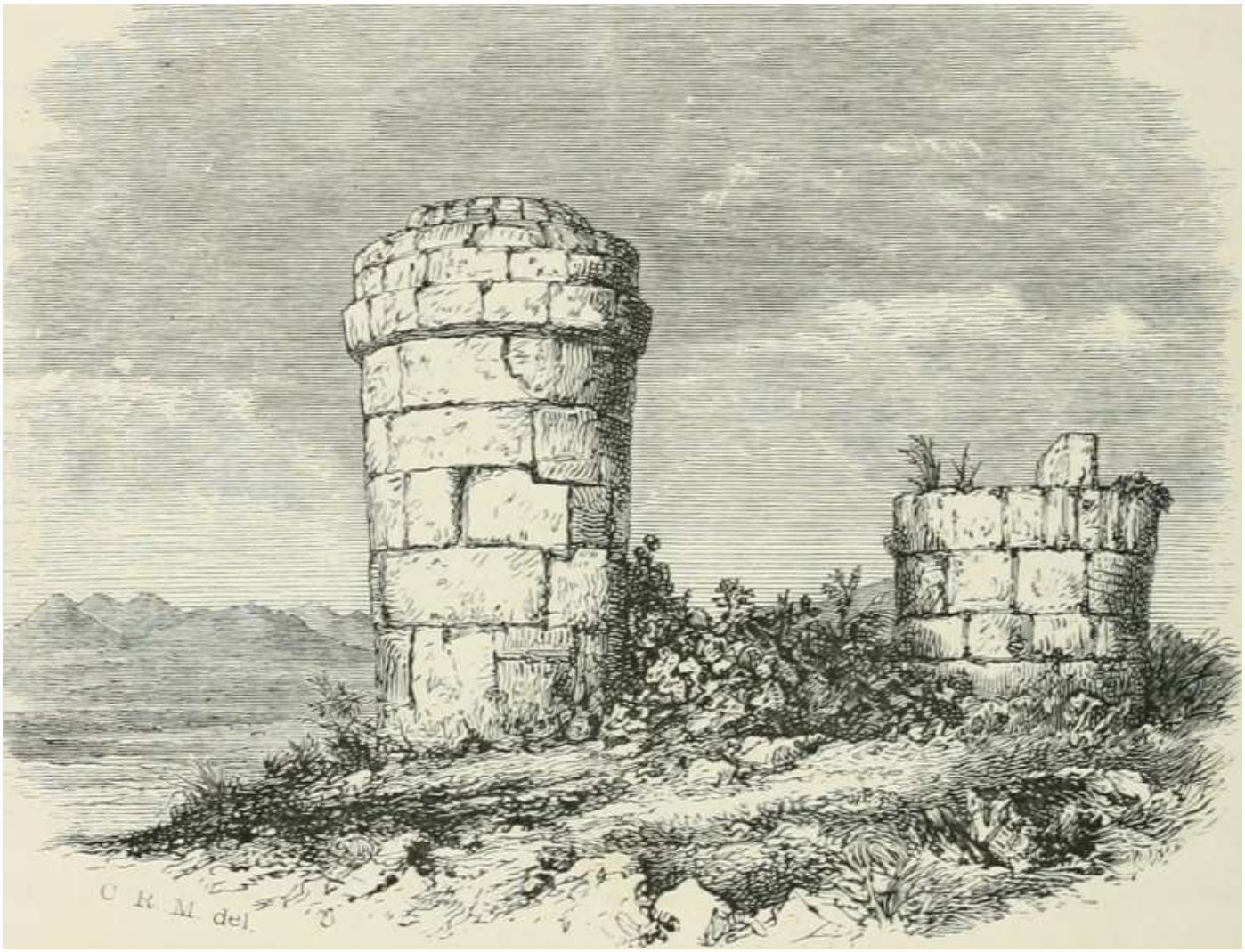
THE region which is drained by rivers flowing from the maritime cordillera and the eastern range of the Andes into lake Titicaca consists of elevated plateaux, seldom less than 13,000 feet above the sea, which were originally inhabited by the Aymara race of Indians, a people differing in some respects from the Indians of Cuzco and further north, and whose civilization dates from a period far anterior to that of the Incas. Their language is different from the Quichua of the Incas, though evidently a sister tongue, and it is still spoken by the Aymara Indians from Puno to the central parts of Bolivia, including all the shores of lake Titicaca. I did not, however, observe much difference between the Indians of Puno, who speak Aymara, and the Quichua Indians of Cuzco. The men are, perhaps, somewhat stouter; but they are the same race in all essential points.

The lake of Titicaca, the great feature in the region inhabited by the Aymara Indians, is about eighty miles long by forty broad; being by far the largest lake in South America. It is divided into two parts by the peninsula of Copacabana; the southern division, called the lake of Huaqui, being eight leagues long by seven, and united to the greater lake by the strait of Tiquina. A number of rivers, which are swollen and of considerable volume during the rainy season, flow into the lake. The largest of these is the Ramiz, which is formed by the junction of the two rivers of Pucara and Azangaro, and enters the lake at its north-west corner. The Suchiz, formed by the rivers of Cavanilla and Lampa, also flows into the lake on its north side, as well as the Yllpa and Ylave; while on the eastern side are the rivers Huarina, Escoma, and Achacache, all flowing from a low lateral chain, parallel with the great eastern Andes, whose gigantic peaks of Illimani and Sorata form the principal feature of the views from all parts of the lake. Much of the water thus flowing in is drained off by the great river Desaguadero, which flows out of the south-west corner, and disappears in the swampy lake of Aullagas, in the south of Bolivia; and perhaps a greater quantity is taken up by evaporation; for the volume of water which flows in during the rainy season, when the sun travels north, is drunk up again when the tutelar deity of the lake returns, between April and September.[147] Indeed it is evident that the waters are steadily receding, under the combined influence of evaporation and of the sediment brought down by the rivers. Lake Titicaca is very deep in some places, the deepest part being on the Bolivian side; but in others it is so shoal that there is only just room to force the balsas through the rushes. The winds blow from the eastward all the year round, sometimes in strong gales, so as to raise a very

heavy sea, during the day-time; but at night they are occasionally westerly. Along the western shore there are acres of tall rushes, and the east winds blow all the dead rushes to the western side, mixing with the living beds, and forming a dense tangled mass. The lake abounds in fish of very peculiar forms, and in aquatic birds.

The principal islands of the lake are those of Titicaca and Coati, near the peninsula of Copacabana; that of Campanario in the east, opposite the town of Escoma, and nine miles from the shore; Soto, also in the northern part, which is said to contain coal;[148] and Esteves, in the bay of Puno, where the patriot prisoners were confined by the Spaniards during the war of independence; besides a small archipelago in the lake of Huaqui.

A very ancient civilization existed on the shores of lake Titicaca long before the appearance of the first Inca of Peru; the principal remains of which are to be found at Tiahuanaco,[149] near the southern shore of the lake of Huaqui. An extensive tract is here covered by huge blocks of carved stone. It was with much regret that I was obliged, by my duty, to give up my intention of visiting these interesting remains. M. de Castelnau mentions two colossal statues of a man and a woman, crowned with a kind of turban; a colossal head and a lizard carved on blocks of stone; a great conical artificial hill; and a monolithic doorway, the upper part of which is covered with very curious sculpture. In the centre there is a figure, probably representing the Sun, and on each side a number of figures all turned towards it, with wings, and sceptres in their hands: those on one side with their heads crowned, and those on the other with heads of griffins, and the bodies adorned with garlands of human heads.[150] All who have visited these ruins consider them to be of a distinct character from those of Cuzco, and other works of the Incas. The stones are more richly carved, and many of them have been united by means of a metal poured into transverse grooves. M. de Castelnau considers that the chief characteristic of Aymara ruins is the minute detail in the carving on the stones, while that of the Incas consists in the grand simplicity of the masonry.[151]



THE TOWERS OF SILLUSTANI.

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On the islands of Titicaca and Coati there are also extensive ruins, the remains of temples and convents of virgins dedicated to the worship of the Sun and Moon; and Dr. Weddell mentions that there is a kind of phlox on these islands (*Cantua buxifolia*), its very elegant long scarlet flower being called by the Aymara Indians the "flower of the Incas."[152]

Although I was unable to visit either the ruins at Tiahuanaco or those on the islands, I found time to examine ruins of the same character on the shores of the lake of Umayu near Vilque, where the great cemetery of the chiefs of the Aymara tribes of the Collao appears to have been. These ruins are at a place called Sillustani, on the north side of the lake of Umayu, where a high rocky table-land juts out so as to form a peninsula, which is literally covered with places of sepulture. Four of them are towers of finely-cut masonry, equal to that of Cuzco, with the sides of the stones dovetailing into each other. On climbing up the steep rocky path which leads to the table-land, the first on the right-hand side is perched on the very edge of the northern precipice. Half of it is

destroyed, the other half is of well-cut stones, with a broad rounded cornice near the summit, and a vaulted roof, part of which remains entire. In the interior, near the foundation, there is a vaulted chamber entered by a small aperture, and full of human bones. The rest of the tower was filled up with small stones and earth, leaving a narrow shaft which ascended from the chamber to the summit, down which the bodies may have been lowered into the chamber.

On the left there is another smaller tower of exactly similar construction. Further on, and near the verge of the southern precipice, there are two other towers close together. One is thirty-six feet high, and built of the same well-cut masonry, with a cornice and vaulted roof, and a great lizard carved in relief on one of the stones near the base, which measures six feet by three.[153] The other tower was apparently exactly similar, but it is now in a very ruinous state.

Besides these more remarkable edifices, the table-land is covered with other towers of rough unhewn stone and earth, and there are the remains of two square edifices built of cyclopean stones. The fallen parts of the towers were covered with masses of bright yellow compositæ called *suncho*, and a purple solanum; and they were frequented by the creepers called *haccacllo*, little green paroquets, a small quail called *pucupucu*, and the little ground-dove *cullca*; numbers of *biscache* rabbits burrowed in the ruins, while two or three lordly *coraquenques* soared in circles over the table-land. After carefully examining the old towers of Sillustani, I passed the night in a very small hut, close to the lake of Umayu, the waters of which were smooth as glass, an island in the centre, and blue ranges of mountains capped with snow in the distance. To get into the hut it was necessary to go on hands and knees, the doorway being only three feet high, with a hide door stretched on a wooden frame. The hut was built of rough stones and thatched with barley-straw; but inside there was a hospitable welcome and good cheer: the old Indian who dwelt there, and his young daughter, providing excellent boiled potatoes, cream-cheese, and fresh milk.

The ruins of Tiahuanaco, and on the islands in the lake, and the towers of Sillustani, are the principal remains of ancient Aymara civilization. Nothing is known respecting the people who raised these imperishable monuments, except that, in the middle of the eleventh century, a man and woman, declaring themselves to be children of the Sun, are said to have first appeared on the shores of the great lake, and, marching north, to have founded the empire of the Incas. The circumstance that Manco Ccapac, the first Inca of Peru, originally appeared in the country of the Aymaras, has led to the belief that he was himself a chief of that nation; but I am more inclined to the opinion that he was one of a band of adventurers who had been brought from Asia, or her vast archipelago of islands, by the westerly winds of the South Pacific, and the southerly breezes of the coast, to the port of Arica; that he thence made his way to the banks of the great lake, where he became indoctrinated in the religion of the people; and that, for some reason,

he continued his wanderings, until he finally collected a sufficiently numerous following to found an independent state at Cuzco. It seems certain, from emblems found carved upon the ruins, and from tradition, that the worship of the Sun and Moon was established amongst the Aymaras for ages before the conquest of their country by the Incas of Cuzco.

It was not for several generations after the foundation of the empire of the Incas, that their conquests were extended over the Aymara nation of the Collao; and it was not until about the middle of the eleventh century that the country on the shores of lake Titicaca became part of the great empire whose centre and capital was at Cuzco. From that time the islands of Titicaca and Coata, and the peninsula of Copacabana, became the most sacred and venerated spots within the dominions of the Incas; as the localities where their great progenitor Manco Ccapac was believed to have made his first appearance.

Copacabana means "the place of a precious stone," *copa* being a precious stone, and *cavana* a place where anything is seen.[154] A rock called Titicaca gave its name to the island and lake: *titi* being Aymara for a cat, and *caca* a rock, for on this rock a cat is said to have sat with fire shooting from its eyes.[155] In Quichua *titi* means lead. On this rock, which is at the west end of the island of Titicaca,[156] there was an altar where the Aymaras adored the Sun, and near it there were three idols joined in one, called *Apu Ynti* (the Chief Sun), *Churip Ynti* (the Son's Sun), and *Yntip Huauqui* (Brother of the Sun). The Inca Tupac Yupanqui (A.D. 1439-75) founded a palace and a village about half a league from the rock, and established a convent of virgins there.[157]

The island of Coata, a league to the eastward of Titicaca, was dedicated to the Moon, the name being derived from Coyata, the accusative of Coya, a queen; the Moon ranking as wife to the Sun. The ruins of the *Accla huasi*, or convent of virgins, on Coata island, are 120 feet long, the interior being divided into numerous cells, with rows of niches in the walls. They are now overshadowed by queñua-trees, whose dark foliage adds to the sombre melancholy of these silent memorials of the past. On both the islands there were, in the time of the Incas, large establishments of Virgins of the Sun, who were divided into three grades, according to their beauty. The most lovely were called *Guayruro*; the next *Yurac Aclla*, or white maidens; and the plain ones *Paco Aclla*, or beast maidens. Each grade was governed by a *Mamacona* or nurse, and an *Apu-panaca* or governor lived near the convent, who guarded it, and supplied its inmates with provisions. The occupations of the virgins were weaving, embroidery, and brewing sacrificial *chicha*, to be poured out on the altar of the deity.[158]

After the conquest, the Spanish Viceroys handed over the province of Chucuito, and the islands in the lake, to the Dominican friars, who succeeded in introducing far grosser and more degrading superstitions amongst the Indians than they had ever practised on the islands of Titicaca and Coata; and in establishing, on the adjacent peninsula of

Copacabana, a shrine, the pretended sanctity of which attracted devotees and rich presents from all parts of Spanish America.

Its origin appears to have been as follows:—A member of the family of the Incas, named Francisco Titu Yupanqui, not having money enough to buy an image of the Virgin for his church, painted a very bad picture, and the cura, Antonio de Almeida, either to please the Indian, or because there were few images or pictures in the country, allowed it to be placed near the altar. But the next cura, Antonio de Montoro, seeing that it caused more laughter than devotion, ordered it to be put in a corner of the sacristy. The poor artist then went to Potosi to learn to paint, and, after much labour, he succeeded in completing a picture which, the moment it was placed in the church at Copacabana, began to work miracles. It was set up in 1583, and the Inca painter died in 1608. The first thing the picture did was to banish all devils out of the province, and to cure many Indians of their diseases; and its fame became so great that in 1588 the Count of Villar, viceroy of Peru, solemnly delivered it to the care of the Augustine friars by a royal edict. Between 1589 and 1652 it is said to have performed 186 miracles. One Alonzo de Escote, for favours received, saved up money for the purpose of giving the Virgin a lamp, and at length he presented the richest then to be found in the Spanish colonies, twenty feet long, with sockets for as many candles as there are days in the year, all of solid silver. Even as late as 1845, when Dr. Weddell saw the church, it was very richly gilt.

"Other images," says Father Calancha, "in Europe and Asia perform miracles in their own towns or provinces, but this picture of Copacabana performs them all over the new world, and in parts of Europe!"[159]

Thus the Spanish conquerors supplied the Aymara Indians of the shores of lake Titicaca with an object of devotion in the shape of this old picture; which was to replace their former simple worship of the Sun and Moon on the sacred islands of the lake. It will be interesting to examine briefly the way the Spaniards treated the people they subjected, in other respects, and to glance at the kind of government which they substituted for the mild rule of the Incas.

The forefathers of the present Aymara Indians established a civilization of which we have no record save the silent evidence of those cyclopean ruins which have just been described. Subsequently, for nearly four centuries, from the middle of the twelfth to the sixteenth, they formed a part of the empire of the Incas, and their land was then called Collasuyu. During this period the Incas followed their constant policy of superseding the language of the conquered land by their own more polished Quichua; and they so far succeeded that the Aymara, which once extended and was spoken all over the Collao, as far as the pass of Ayaviri, on the road to Cuzco, has been entirely superseded in all parts north of Puno by the Quichua, and is now only spoken between Puno and La Paz, and farther south. Nevertheless the people enjoyed a long period of tranquillity and

prosperity during the happy rule of the Incas, and the population continued to increase. With the introduction of Spanish rule a blight fell upon them: and we shall now see how the beneficent laws of the sovereigns of Castile were administered by their unworthy servants.

CHAPTER VIII.

THE PERUVIAN INDIANS:

Their condition under Spanish colonial rule.

In reviewing the deplorable results of Spanish domination in South America, it may at once be conceded that the legislation which originated from the councils of the kings of Castile was always, except in matters connected with religion, remarkable for beneficence and liberality in all that concerned the natives; and that, in the words of Mr. Helps, "those humane and benevolent laws, which emanated from time to time from the Home Government, rendered the sway of the Spanish monarchs over the conquered nations as remarkable for mildness as any, perhaps, that has ever been recorded in the pages of history."[160] It may also be allowed that the Viceroys of Peru were generally earnest and zealous statesmen, who conscientiously strove to enforce the regulations which they from time to time received from the council of the Indies.

But it was almost as impossible for the viceroys to exercise efficient personal supervision over the government of so enormous a country, while residing at Lima, as it would have been if they had remained at the council-table in Seville; and their subordinates were, as a body, untrustworthy, extortionate, rapacious, and often remorselessly cruel. Thus the benign laws of the Spanish kings became a dead letter in South America, and the natives groaned, for three centuries, under a yoke which crashed them to the earth, and converted vast tracts of once thickly populated country into uninhabited deserts.

Yet the humane intentions of the Spanish government, and the labours of the Peruvian viceroys, were not wholly without results; and it is partly due to them that a system of worse than African slavery was not established in Peru, and that the native race has not long ago become entirely extinct.

At the time of the Spanish conquest Pizarro was empowered, in 1529, to grant "*encomiendas*," or estates, to his fellow-conquerors, the inhabitants of which were bound to pay tribute to the holders of the grants; and in 1536 these *encomiendas* were extended to two lives. The consequent exactions and cruelties were so intolerable that the good Las Casas, and other friends of the Indians, at length induced the Emperor Charles V. to enact the code so well known as the "New Laws," in 1542; by which the *encomiendas* were to pass immediately to the Crown after the death of the actual holders; all officers under government were prohibited from holding them; all men who had been mixed up in the civil wars of the Pizarros and Almagros were to be deprived

at once; a fixed sum was to be settled as tribute to be paid by the Indians; and all forced personal labour was absolutely forbidden.

The promulgation of these beneficent laws excited a howl of furious execration from the conquerors,—the wolves who were thus to be dragged away, when their fangs were actually fixed in the flesh of their victims. Gonzalo Pizarro rose in rebellion in Peru, and defeated and killed Blasco Nuñez de Vela, the viceroy who had arrived to enforce these "New Laws;" while the more politic Belalcazar, at Popayan, though professing obedience, contrived to evade the execution of his orders, after a fashion which gave rise to the well-known saying—"*se obedece, pero no se cumple*"—"he obeys, but does not fulfil." Their unpopularity was so great that it was considered unsafe to persist in the attempt to enforce them, and they were revoked in 1545. The President Gasca re-distributed the "*encomiendas*" in 1550, and they were granted for three lives in 1629. Gasca, who showed more regard for his own safety and convenience than for the public service, arranged that his settlement of the *encomiendas* should not be promulgated until he had sailed for Spain, and he suspended the law prohibiting the forced personal service of the Indians. The latter enactment, however, was boldly promulgated by the Judges of the Royal Audience in 1552, and was, as might have been expected, immediately followed by a ferment amongst the conquerors and a formidable rebellion. Finally the Marquis of Cañete arrived in Peru, as viceroy, in 1554; and, by a mixture of severity and prudent conciliation, trod out the last sparks of revolt amongst the Spaniards.

In 1568 the viceroy Don Francisco de Toledo established the system under which the native population of Peru was professedly ruled for the two succeeding centuries. Toledo was a bigot, without pity, and inexorably cruel. Justice or humanity had no weight with him if they stood in the way of any policy which he deemed to be advisable, as was shown in the judicial murder of the young Inca Tupac Amaru. But he was a faithful servant of his sovereign, and resolutely determined to enforce the edicts of the Council of the Indies; a statesman of considerable ability and untiring industry. He was so prolific in legislation that, on the subject of coca-cultivation alone, he issued seventy ordinances; and future viceroys referred to his rules and enactments as to a received and authoritative text-book. The viceroy Marquis of Montes Claros, in 1615, declared that "all future rulers of Peru were but disciples of Francisco de Toledo, that great master of statesmanship."

By his *Libro de Tasas*, or Book of Rules, Toledo fixed the tribute to be paid by the Indians, exempting all men under the age of eighteen, or over that of fifty. The Indians were governed by native chiefs of their own people, whose duty it was to collect the tribute, and pay it in to the Spanish corregidor or governor of the province, as well as to exercise subordinate magisterial functions. These chiefs, called *Curacas* in the time of the Incas, were ordered by Toledo to be named *Caciques*, a word brought from the West

Indian islands;[161] and under them there were two other native officials—the *Pichca-pachacas*, placed over 500 Indians, and the *Pachacas* over 100. These offices were inherited from father to son, and their possessors enjoyed several privileges, such as the exemption from arrest, except for grave offences, and they received a fixed salary. The native Caciques were often men of considerable wealth; some of them were members of the royal family of the Incas; they were free from the payment of tribute and from personal service; and thus occupied positions of importance amongst their countrymen.[162] They wore the same dress which distinguished the nobles of the Inca's court, consisting of a tunic called *uncu*, a rich mantle or cloak of black velvet called *yacolla*, intended as mourning for the fall of their ancient rulers; and those of the family of the Incas added a sort of coronet, whence a red fringe of alpaca-wool descended as an emblem of nobility. This head-dress was called *mascapaycha*. They had pictures of the Incas in their houses, and encouraged the periodical festivals in memory of their beloved sovereigns, when plays were enacted, and mournful music was produced from the national instruments, drums, trumpets, clarions, and *pututus*, or sea shells.[163] All these customs were left unchanged by Toledo, and the system so far resembles that which now prevails in the Dutch colony of Java.[164]

But, in addition to the tribute, the amount of which as established by Toledo was not excessive, and which was rendered still less objectionable to the Indians from being collected by their native chiefs, there was the *mita* or forced labour in mines, manufactories, and farms,[165] which became the instrument of fearful oppression and cruelty. Toledo enacted that a seventh part of the adult male population of every village should be subject to the *mita*, and ordered that the Caciques should send these *mitayos*, as they were called, to the public squares of the nearest Spanish towns, where they might be hired by those who required their services; and laws were enacted to regulate the distance they might be taken from their homes, and their payment.[166] It appears, however, that this seventh part of the working men who were told off for forced labour was exclusive of those employed in the mines, so that, even in theory, the *mita* condemned a large fraction of the population to slavery.[167]

There was a class of Indians, numbering about 40,000 souls in the time of Toledo (1570), called *Yanaconas*, who were scattered over Peru, and forced to work on the lands of Spaniards, or as domestic servants. They may have been descendants of captives in war, or of persons who had been condemned to slavery in the time of the Incas, and thus became the property of the conquerors; but in 1601 an enactment was promulgated to ameliorate their condition, and fix the terms of their service.[168]

In matters connected with religion the Spanish legislators allowed of no temporizing policy. All signs of idolatry must disappear, and with the new religion came additional exactions, in the shape of fees for masses, burials, and christenings. Toledo enacted

many laws for the suppression of the old religion of the Incas: any Indian who married an idolatrous woman was to receive one hundred stripes, "because that is the punishment which they dislike most;" the people were prohibited from using surnames taken from the names of birds, beasts, serpents, or rivers, which was their ancient custom; and no Indian who had been punished for idolatry, joining in infidel rites, or dancing the dance called *arihua*, could be appointed to hold any public office.[169]

On the whole, however, the legislation of the Spanish kings, and the reports of the viceroys of Peru, display an earnest desire to protect the Indians from tyranny, and to render their condition tolerable. In 1615 the Marquis of Montes Claros impressed on his successor the importance of obliging all classes of Spaniards to treat the Indians well, and of chastising oppression with rigour. In 1681 the Count of Castellar states that one of the points most dwelt upon in the instructions given to the viceroys, and in repeated royal enactments, was the humane treatment of the Indians; and he declares that he always sought to enforce these orders from the day that he landed in Peru; and words to the same effect are to be found in the reports of most of the other viceroys.[170]

But side by side with these evidences of the good intentions of the Government, is the testimony of the viceroys that their efforts to comply with these beneficent orders, and enforce these humane laws, were fruitless, and rendered of no effect by the unworthiness of their subordinates; and almost all complain of the rapid depopulation of the country. In 1620 the Prince of Esquilache reported that "the arm of the viceroy was not powerful against the negligence and maladministration of the corregidors;" in 1681 the Count of Castellar said that he had to correct and punish the excesses both of the corregidors and the curas; in 1697 the Duke of La Palata speaks of the depopulation of the villages and towns, caused by the forcible detention of the Indians to work at the mines, in cloth and cotton workshops, and in farms; and another viceroy attributes the rapid depopulation of the country to the same causes, and also to drink, and urges a closer supervision of the conduct of the corregidors and curas.

I have, in a former work, given a brief account of the treatment of the Indians, and of the way in which the laws intended for their defence were evaded; from the evidence of the brothers Ulloa, who were commissioned to make a special and secret report on the subject to the King of Spain in 1740.[171] I have since collected abundant testimony to the same effect, printed and in manuscript, both at Madrid and in Peru; but I have only space for a few brief notes, which must serve to illustrate this part of the subject.

The mines of Potosi were supplied with labourers from the nearest provinces, by enforcing a *mita* of a seventh of the adult male population. In 1573 this *mita* consisted of 11,199 Indians, in 1620 of 4249, and in 1678 of 1674,[172] a decrease which marks the rapid depopulation of the country; and, at the latter date, when the authorities at Potosi failed to receive a sufficient number of labourers by the ordinary *mita*, they

kidnapped people in their homes, and on the roads, and carried them off to forced labour in the mines. The law was that the *mitayos* should be paid for coming and going, and that they should not be forced to work at night; but these laws were habitually set at nought, and Potosi became an exhausting drain to the surrounding country.[173]

The mines of Huancavelica, which supplied the quicksilver necessary for extracting the silver of Potosi from its ores,[174] also desolated the ten adjoining provinces. In 1645 the *mita* or seventh part of the adult male population amounted to 620, and in 1678 to only 354 Indians. The *mita* was a service which was abhorred and dreaded by the people, and mothers maimed the arms and legs of their children to deliver them from this slavery. Don Juan de Padilla relates that, in 1657, when he was at Santa Lucia, in the province of Lucanas, he saw the women of the village go out to assist each other in sowing their fields, and, at the end of their labour, they returned hand in hand, singing a most melancholy song, and lamenting the cruel fate of their husbands and brothers, who were slaving in the mines of Huancavelica, while they were obliged to work in the fields like men. They declared that when a man was once taken for the *mita* his wife seldom or never saw him again, unless she went herself to the place of his torments.[175]

The oppression of the owners of *obrajes* or manufactories of coarse woollen and cotton cloths, in enforcing the *mitas*, was as crushing as that of the miners. These people employed men, called *guatacos*, to hunt the Indians, and drive them into the *obrajes*. If they could not find the particular men for whom they were in search, they took their children, wives, and nearest neighbours, robbed them of all they possessed, and frequently violated the women and young girls.[176] The masters, in the *obrajes*, then forced their victims to get deeply in debt to them, and thus obtained an excuse for keeping them in perpetual slavery. In many *obrajes* there were Indians who had not been outside the walls for forty years and upwards. The law was that the natives should be free from tribute and personal service until they attained the age of eighteen; but it was the general practice to drag children from their homes at the ages of six or eight, force them to work hard at twisting woollen and cotton threads, and flog them cruelly.[177]

Thus the work of depopulation went on until, in 1622, many *encomiendas* which originally contained a thousand adult male Indians, and yielded eight thousand dollars of tribute, were reduced to a hundred; yet these unfortunate survivors were forced to continue the payment of the original tribute, or to render personal service instead. There was an *encomienda* in Huanuco where the Indians had paid more than one hundred thousand dollars over and above what was legally due, during fifty years.[178]

It may well be asked of what use were the humane and beneficent laws enacted by the kings of Spain if this was the way in which they were universally evaded by corregidors, curas, and Spanish settlers of all ranks? The caciques sorrowfully watched the gradual extinction of their people, perhaps secretly hoped for an opportunity of

revenge, but were without power to prevent the cruel oppression which they deplored, though they did not neglect, from time to time, to protest against the lawless exactions and cruelties of the Spaniards.[179]

But the Indians did not endure their fate without occasional attempts at resistance. On one occasion the people on the western shore of lake Titicaca rose against the *mita* of Potosi, and retreated amongst the beds of rushes on the shores of the lake, which, in some places, are nine leagues long and one broad. In the midst of these rushes there was an island, whence secret lanes were cut through the tangled mass, which the fugitives navigated in their balsas. Secure in their retreat, they continued to make inroads on the Spanish towns near the lake, until at last, in 1632, the viceroy Count of Chinchon ordered his nephew, Don Rodrigo de Castro, to chastise them. Five of their leaders were captured and hung at Zepita, and their heads were stuck on the bridge over the Desaguadero. This only exasperated the Indians, who elected a brave and enterprising leader named Pedro Laime, and, suddenly attacking the bridge over the Desaguadero, they carried off the heads of their former chiefs. The Spaniards marched along the shore and waded to some islets, while the Indians hovered round them in their balsas, and prevented them from advancing further. At length the Spanish troops were embarked in twenty balsas, and came in sight of the hostile squadron commanded by Laime. The Indians went in and out of the lanes of rushes only known to themselves, baffled their oppressors, and cut off several of the Spanish balsas. A party of cavalry advancing into the swampy ground was suddenly surrounded and cut to pieces, the Indians only losing three men.[180]

Thus the fugitive Indians retained their liberty for many years in these inaccessible fastnesses of lake Titicaca, and the Augustine friar Calancha confesses that "the rebellion was caused by the injustice and tyranny of the Spaniards, who forced the Indians to work without pay, and seized on their goods."

This was not a solitary instance of rebellion, though, on the whole, the Indians endured their cruel fate with meekness and long suffering. Yet they are not a mean-spirited people, and at length they showed their oppressors that it was possible to press the yoke down too hard even for their powers of endurance.

The tribute, the *mita*, the exactions of the curas, and the *alcabala*, or excise duties,[181] were all patiently borne; but another method of extortion, the "*repartimiento*," or "*reparto*,"[182] at length exhausted the patience of the over-tasked Indians. The *reparto* was a system, ostensibly for distributing European goods to the Indians, which was converted into a means of wholesale robbery by the Spanish corregidors, and finally led to a general rebellion. An Indian chieftain thus describes the *reparto* system:—"Abandoning their souls for their avarice, the corregidors have the assurance to distribute (*repartir*) by force, and against all reason, baize and cloths worth two rials

for one dollar, and in the same proportion with knives, needles, dice, pins, cards, trumpets, rings, and pewter mirrors, which are all quite useless to the Indians; besides velvets and silks, which the poor people cannot use; for they are obliged to dress in the coarsest clothes, to sleep on beds of rags, and feed on roots; while the corregidors and their dependants commit the most unjust extortions and outrages. They even exceed the legal quantity of *repartos* assigned to their respective provinces; for example, that of Tinta was ordered to be 112,500 dollars, and the corregidor made it 500,000 dollars, as was proved by his books and papers."[183] General del Valle, who commanded the troops employed to put down Tupac Amaru's rebellion, complained that the avarice of the corregidors, in recovering their claims on the Indians for *repartos*, was such that they refused him the aid of their people in pacifying the country. Their obstinacy and avarice, he declared, had reached to such a point that, if they were informed that the rebels had reached the very suburbs of their towns, they would rather see the defeat of the king's troops than send away a single Indian who might owe them a yard of cloth. [184]

This unblushing dishonesty and extortion, which was winked at by the Royal Audience at Lima, the highest court of judicial appeal, drove the Indian population to a state of desperation, which only required a spark to set it in a blaze. The humane laws, and the elaborate system of legislation for the Indians, had, after 200 years of hopeless inefficiency, ended in this. The careful enactments to limit the amount of tribute, to prevent the Indians from suffering by forced personal service, the laws of ecclesiastical councils to protect them from the exactions of the curas, the benevolent intentions evinced in declaring all Indians to be minors in the eye of the law, the "*residencias*," or arrangements for examining the conduct of every official at the close of his term of office; all these provisions, which have justly called forth the praise of Mr. Helps, Mr. Merivale,[185] and other modern writers, had become dead letters, absolutely and hopelessly, towards the end of the last century. The laws remained the same, but they were habitually set aside by those whose duty it was to administer them. The tribute fixed for villages when they contained a thousand men was continued the same when the population had decreased to a hundred;[186] the *mita* was enforced so mercilessly that whole districts were left without a single adult male inhabitant;[187] the curas extorted exorbitant fees from their victims, in spite of the law;[188] and the judges, who were sent to take the "*residencias*," received bribes to overlook all offences, and usually handed over the complaints which were submitted to them to the officials who were complained of in exchange for a sum of money, the price of their silence.[189] These evils were long borne patiently; but when the shameless enormities of the *Repartos* were superadded, the poor remnant of the descendants of the subjects of the Incas at length rose as one man against their oppressors.

There were not wanting, amongst the Spaniards in Peru, as well as amongst the native Caciques, many good and humane men who raised their voices against the lawless cruelty of the majority of the officials, and earnestly warned the Government of the inevitable consequences. Don Ventura Santalices, the Governor of La Paz, devoted his time and fortune to the cause of the oppressed Indians, and was appointed to a seat in the Council of the Indies, but he was poisoned on his arrival in Spain: the energetic remonstrances of Blas Tupac Amaru, a descendant of the Incas, caused him also to be summoned to Spain, where he obtained promises of many concessions, but he was assassinated at sea, during the return voyage: and the names of other bold and fearless defenders of the Indians deserve to be recorded, such as Don Manuel Arroyo, Don Ignacio Castro, Don Agustin de Gurruchategui, Bishop of Cuzco, and Don Francisco Campos, Bishop of La Paz.

But their remonstrances bore no fruit, and, in 1780, the Corregidor of Chayanta having exacted three *repartos* in one year, an Indian chief, named Tomas Catari, set the example of revolt; thousands flocked to his standard, and to those of his brothers Damaso and Nicolas; in a few months the whole of Upper Peru (the modern Bolivia) was in revolt, and an army of Indians under Julian Apasa, a baker of Hayohayo near Sicasica, besieged La Paz.[190] At the same time there was an uneasy feeling at Cuzco and throughout Peru, and whispers of a conspiracy amongst the Indians. Don Pedro Sahuaraura, the Cacique of Oropesa, near Cuzco, reported that one Ildefonso del Castillo had solicited him to join the conspiracy; suspicion was thrown on several other influential Indians; and in June 1780 this Castillo, Bernardo Tambohuacto, the Cacique of Pissac, and six others, were put to death at Cuzco.[191] In the following November the Cacique José Gabriel Condorcanqui, better known as Tupac Amaru, raised the standard of revolt, and the last desperate struggle for liberty was commenced by the descendant of the Incas.[192]

"It would be difficult," says Dean Funes, "to find in the history of revolutions one more justifiable and less fortunate than that of Tupac Amaru. America had, in those days, become the theatre of the most wide-spread tyranny; but the Indians of Peru were those on whose necks the yoke weighed heaviest. *Mitas* and *repartos* were, in Peru, the deadly plagues of Spanish invention, which devoured the human race."[193]

I am enabled to give a more correct and circumstantial account of the great rising of the Peruvian Indians in the end of the last century than has yet appeared in Europe; although, as this interesting subject is a digression from the main purpose of the present work, I shall be obliged to compress my narrative within the narrow limits of one or two chapters.[194] In this brief sketch of the state of the Peruvian Indians under Spanish rule, I have endeavoured to establish the fact that Tupac Amaru's rebellion was justified because the oppression of his people had become intolerable, and because all law was set at defiance by the Spanish officials. He protested, not against the tyranny of the laws,

but against the infringement of laws, and the oppressive acts done in spite of the laws, by those whose duty it was to administer them.

In writing on this subject one is apt to be carried away by indignation against the Spanish rulers in South America; yet, if we look round at the systems of colonization pursued by other European nations, it will be found difficult to say who has a right to cast the first stone. The Spanish colonies, however, cannot properly be compared with those modern English settlements, to which thousands of the labouring classes have emigrated, and either annihilated the natives, or fenced them off by a system of reserves and isolation. No European labouring class was introduced into South America; the Indians still continued to be the cultivators, the shepherds, and the artizans; and the Spaniards were merely the dominant race. This state of things is more allied to the conditions which now exist in British India or Dutch Java, and there is thus no analogy between the South American settlements and any British colony in the proper acceptation of the word.

Yet to Spain the credit is due, in spite of numerous shortcomings, and notwithstanding the oppression of her subordinates, of having endeavoured to establish the wisest, the most humane, and the only successful system of treating natives of an inferior race. It is certain that such a race must either continue to form the mass of the population, amalgamate with their conquerors, or be annihilated. The two former of these three alternatives were adopted in Peru, partly from natural causes, but partly also owing to the incessant exertions of the earlier Spanish viceroys, and of the "Defenders of the Indians;" and this result was achieved in spite of the oppression and cruelty of their subordinates. The Indians have continued to form the labouring class of Peru; amalgamation has taken place, to a very large extent, with Europeans; and the native race has thus been preserved from extinction.[195] In the English colonies, on the other hand, owing to the influx of settlers of the labouring class, the aborigines have either been exterminated, or, through a system of isolation, are rapidly and inevitably advancing on the melancholy road to final annihilation.

But it was the intention of the Spanish system to do more for the aboriginal race than merely to preserve it from extinction. By adopting a system of tutelage, as regarded the Indians, the Spanish Government endeavoured to defend them, in legal matters, from the superior intelligence of a more civilized race; and Mr. Helps points out that it is hardly possible to carry legislation further, in favour of any people, than by considering them as minors in the eye of the law, in order to protect them from being imposed upon in their dealings with their conquerors.[196] The opposite plan, which has been adopted in some of the English colonies, of making native tribes equal to Europeans in the eye of the law, is a mere mockery, and cannot by any possibility exist in reality.[197]

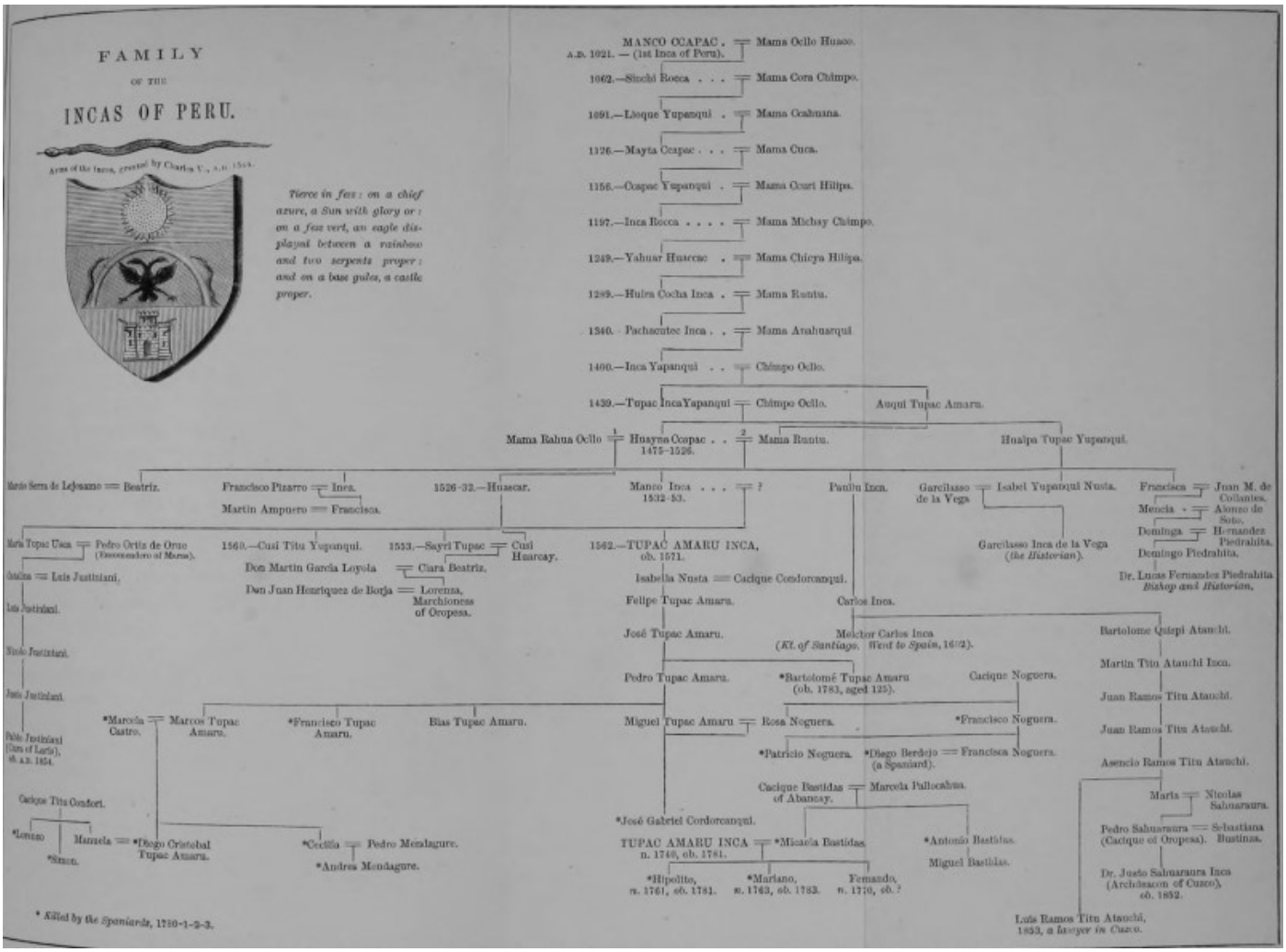
It may then be readily allowed that the intentions of the Spanish Government towards the Indians were humane and just; that their legislation was invariably marked by

tenderness and concern for the subject race; and that their policy, had it been carried into effect, was far more wise and generous than that by which modern nations have generally been influenced in dealing with the aborigines of their colonies. But I think I have clearly shown that, through the unworthiness of their subordinates, this policy was only very partially enforced; that the cruelty and oppression of the colonial officials at length became insufferable; and that no cause could be more just than that in which Tupac Amaru, the last of the Incas, at length drew his sword.

CHAPTER IX.

NARRATIVE OF THE INSURRECTION OF JOSÉ GABRIEL TUPAC AMARU, THE LAST OF THE INCAS.

THE basin of lake Titicaca is bounded on the north by the mountains of Vilcañota, which unite the maritime cordillera with the Eastern Andes, and the river of Vilcamayu rises in these mountains, and flows north through a fertile and well-peopled valley, which is covered with fields of Indian corn. The road from Puno to Cuzco, after crossing the Vilcañota range by the pass of Santa Rosa, descends the valley of the Vilcamayu, passing through the towns of Marangani, Sicuani, Cacha, Tinta, Checacupe, Quiquijana, and Urcos; and then leaves the river near Oropesa, and ascends a valley for three leagues to the city of Cuzco. On either side of the ravine of Vilcamayu are lofty table-lands, which only yield potatoes and quinoa; the wild hills are covered with coarse grass, often weighed down with snow; and in several places there are large Alpine lakes. Uninviting as this bleak region appears, it still contains several Indian villages, ruled in 1780 by native caciques, who were subject to the corregidor of Tinta, in the valley. The principal villages under the jurisdiction of Tinta in this cold and lofty district are Sangarara, Lanqui, Pampamarca, Surimani, Yanaoca, and Tungasuca—the latter of which was the home of Tupac Amaru. It is a small village, with a few patches of potatoes and quinoa round it, near the banks of a wild-looking lake, with rocky mountains rising abruptly from the water.


FAMILY
OF THE
INCAS OF PERU.
Arms of the Incas, granted by Charles V., A.D. 1544.
Tierce in fess: on a chief azure, a Sun with glory or: on a fess vert, an eagle displayed between a rainbow and two serpents proper: and on a base gules, a castle proper.
MANCO CCAPAC. = Mama Ocllo Huaco.
A.D. 1021. — (1st Inca of Peru).
1062.—Sinchi Rocca . . . = Mama Cora Chimpo.
1091.—Lloque Yupanqui . = Mama Ccahuana.
1126.—Mayta Ccapac . . . = Mama Cuca.
1156.—Ccapac Yupanqui . = Mama Ccuri Hilipa.
1197.—Inca Rocca . . . . = Mama Mikay Chimpo.
1249.—Yahuar Huaccac . = Mama Chicya Hilipa.
1289.—Huira Cocha Inca . = Mama Runtu.
1340. Pachacutec Inca . . = Mama Anahuarqui
1400.—Inca Yupanqui . . = Chimpo Ocllo.
1439.—Tupac IncaYupanqui = Chimpo Ocllo. Auqui Tupac Amaru.
Mama Rahua Ocllo = Huayna Ccapac . . = Mama Runtu. Hualpa Tupac Yupanqui.
1475–1526.
Manco Inca . . . = ?
1532–53.
Paullu Inca.
Garcilasso de la Vega
Isabel Yupanqui Nusta.
Francisca = Juan M. de Collantes.
Menicia = Alonzo de Soto.
Dominga = Hernandez Piedrahita.
Domingo Piedrahita.
Dr. Lucas Fernandez Piedrahita
Bishop and Historian.
Garcilasso Inca de la Vega
(the Historian).
Francisco Pizarro = Inca.
Martin Ampuero = Francisca.
1526–32.—Huascar.
1560.—Cusi Titu Yupanqui.
Don Martin Garcia Loyola = Clara Beatriz.
Don Juan Henriquez de Borja = Lorenza, Marchioness of Oropesa.
1553.—Sayri Tupac = Cusi Huarcay.
1562.—TUPAC AMARU INCA, ob. 1571.
Isabella Nusta = Cacique Condorcanqui.
Felipe Tupac Amaru.
José Tupac Amaru.
Pedro Tupac Amaru.
Carlos Inca.
Melchor Carlos Inca
(Kt. of Santiago. Went to Spain, 1602).
*Bartolomé Tupac Amaru
(ob. 1783, aged 125).
Cacique Noguera.
Miguel Tupac Amaru = Rosa Noguera.
*Francisco Noguera.
*Patricio Noguera.
*Diego Berdejo = Francisca Noguera.
(a Spaniard).
Cacique Bastidas of Abancay. = Marcela Pallocahua.
*José Gabriel Cordorcanqui.
TUPAC AMARU INCA = *Micaela Bastidas.
n. 1740, ob. 1781.
*Antonio Bastidas.
Miguel Bastidas.
*Hipolito, n. 1761, ob. 1781.
*Mariano, n. 1763, ob. 1783.
Fernando, n. 1770, ob. ?
Bartolome Quispi Atauchi.
Martin Titu Atauchi Inca.
Juan Ramos Titu Atauchi.
Juan Ramos Titu Atauchi.
Asencio Ramos Titu Atauchi.
Maria = Nicolas Sahuaraura.
Pedro Sahuaraura = Sebastiana Bustinza.
(Cacique of Oropesa).
Dr. Justo Sahuaraura Inca
(Archdeacon of Cuzco),
ob. 1852.
Luis Ramos Titu Atauchi,
1853, a lawyer in Cuzco.
Maria Sierra de Lejesama = Beatriz.
Martin Tupac Inca = Pedro Ortiz de Orue
(Encomendero of Maras).
Catalina = Luis Justiniani.
Luis Justiniani.
Nicolo Justiniani.
Justo Justiniani.
Pablo Justiniani
(Earl of Larlo),
ob. A.D. 1854.
Cacique Titu Condori.
*Lorenzo
*Simon.
Manuela = *Diego Cristobal Tupac Amaru.
*Marcela Castro.
Marcos Tupac Amaru.
*Francisco Tupac Amaru.
Blas Tupac Amaru.
*Cecilia = Pedro Mendagure.
*Andres Mendagure.
* Killed by the Spaniards, 1780-1-2-3.

FAMILY OF THE INCAS OF PERU.

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José Gabriel Condorcanqui or Tupac Amaru,[198] the son of the Cacique Miguel Tupac Amaru by his wife Rosa Noguera, was born at Tinta in the year 1742, and baptized at Tungasuca, the birthplace of his father.[199] He claimed to be the representative of the family of the Incas, as fifth in lineal descent from Tupac Amaru, the son of the Inca Manco, who was judicially murdered by the Viceroy Toledo in 1571.

The young José received the first rudiments of his education from two neighbouring clergymen, Antonio Lopez, Cura of Pampamarca, a native of Panama, and a man of considerable talent; and Carlos Rodriguez, Cura of Yanaoca, a native of Guayaquil. At a very early age, however, he was sent to the Jesuit college of San Borja at Cuzco, which had been established for the education of young Indian chiefs. He is said to have been particularly noticed by the professors for his close application, capacity, and excellent disposition; and his scholastic acquirements were not inconsiderable. He spoke Spanish with fluent accuracy, and his vernacular Quichua with peculiar grace.[200]

Before he was twenty he succeeded his father as Cacique of Tungasuca, Pampamarca, and Surimani, three villages situated on the cold and lofty region which overhangs the valley of the Vilcamayu; and in 1760 he was married to Micaela Bastidas, a beautiful Indian girl of Abancay.[201]

In person José Tupac Amaru was five feet eight inches in height, well-proportioned, sinewy, and firmly knit. He had a handsome Indian face, a slightly aquiline nose, full black eyes, and altogether a countenance intelligent, benign, and expressive. His address, remarkable for gentlemanlike ease, was dignified and courteous towards superiors and equals; but in his intercourse with the aborigines, by whom he was profoundly venerated, there was a sedateness not inconsistent with his legally-admitted claims (de jure) to the diadem of the Incas. In mind he was enterprising, cool, and persevering. He lived in a style becoming his rank, and, when residing at Cuzco, usually wore a black velvet coat and small-clothes in the fashion of the day, a waistcoat of gold tissue, embroidered linen, a Spanish beaver dress hat, silk stockings, and gold knee and shoe-buckles, and he allowed his glossy black hair to flow in ringlets which extended down nearly to his waist.[202] The chief source of his income arose from thirty-five *piaras* or troops of mules, each *piara* consisting of ten, which were regularly employed or hired out in the transport of merchandise, home-made stuffs, sugar, and quicksilver to Potosi and other parts.[203] He had travelled over a considerable portion of Peru, and had two or three times resided in Lima; and in his journeys he was always attended by a small retinue of Indians, and sometimes accompanied by a chaplain.

In about 1770 Tupac Amaru went to Lima to establish his claim to the Marquisate of Oropesa, which had been granted to his family by Philip II. After some delay his claim was acknowledged by the Royal Audience, and, in a judgment pronounced by the Fiscal Don Serafin Leytan y Mola, he was declared to be the heir to the marquisate, as fifth in lineal descent from the Inca Tupac Amaru; but it would appear that this judgment was withheld from official publication. It was said that the fiscal paid the successful suitor so many honours, and said so many complimentary things concerning his nobility and royal descent, that he grew proud;[204] and it certainly appears that he adopted a style of living in his mountain home at Tungasuca, after his return from Lima, which he had not previously assumed.[205] It is remarkable that, in 1618, the Viceroy Prince of Esquilache wrote a despatch on the claims to jurisdiction of the members of the Inca family, who were heirs to the marquisate of Oropesa. He represented that very great inconvenience might arise from any descendant of the Incas, particularly of the family of Oropesa, so closely representing the direct line, holding any jurisdiction in Peru. The estates of the marquisate were the richest and best in Peru, and situated near Cuzco, where the memory of the Incas was most cherished. Many descendants of the Incas, he added, were then living, subject to no tribute and no personal service, and very rich and powerful; and he recommended that all claimants to the marquisate should be obliged to

live in Spain, and that an equivalent should be paid them for their estates.[206] This advice was not adopted by the Council of the Indies.

The young Inca at this time dropped his surname of Condorcanqui, and assumed that of Tupac Amaru Inca. He governed his villages of Tungasuca, Surinani, and Pampamarca exceedingly well, and was highly esteemed by the corregidor of the province, Don Pedro Muñoz de Arjona, and his successors, who admired his punctual attention to his duty, and therefore distinguished him above all the other caciques. He habitually cultivated the acquaintance of the Spanish curas and officials, and never let pass an opportunity of representing to them, in impassioned language, the deplorable condition of the Indians.[207] He assisted the distressed, paid tribute for the poor, and sustained whole families which had been reduced to ruin.[208] He cherished the traditions of his people, and such customs as were not inconsistent with his profession of Christianity; and he especially delighted in the dramatic representations which recalled the glorious memories of the past. One of his most intimate friends was Dr. Antonio Valdez, Cura of Sicuani, a perfect master of the Quichua language, and author of a play called 'Ollantay,' founded on ancient tradition, which was frequently acted before Tupac Amaru at Tungasuca.[209]

The oppression of the Indians by means of the *mitas* and *repartos* excited the indignation of the Inca Tupac Amaru; but he exerted himself for years, and exhausted every means of obtaining redress, before he was finally driven to take up arms in their defence. Moved by his earnest and incessant appeals, and his piteous account of the sufferings of his people, the Bishops of Cuzco and La Paz forwarded them to the king through Don Ventura Santalices; and Blas Tupac Amaru, the Inca's uncle, also undertook a voyage to Spain; but death put an end to the humane missions both of the Spaniard and the Indian. Nevertheless, Tupac Amaru persevered in remitting renewed petitions; while the corregidors not only eluded compliance with the royal decrees, but also increased the burdens of the Indians. At length his patience came to an end, and he resolved to make an appeal to arms, not to throw off the yoke of Spain, but to obtain some guarantee for the due observance of the laws, and their just administration. His views were certainly confined to these ends when he first drew his sword, although afterwards, when his moderate demands were only answered by cruel taunts and brutal menaces, he saw that independence or death were the only alternatives.

The most merciless oppressor of the Indians of Peru was Don Antonio Aliaga, Corregidor of Tinta, and therefore Tupac Amaru's immediate superior; and the Inca determined to commence his revolt by punishing this great culprit. The Inca's old tutor, Dr. Carlos Rodriguez, Cura of Yanaoca, in celebration of his name-day, gave a dinner to the corregidor of Tinta, and the Inca Tupac Amaru, on the 4th of November, 1780. The Inca, on pretence that some person had arrived at his house from Cuzco, withdrew from the banquet early, and placing himself in ambush on the road, with some attendants,

made the corregidor prisoner on his return, taking him to Tungasuca,[211] and placing him in close confinement. Tupac then wrote a letter marked *reservadissima*, which he obliged Aliaga to sign, ordering his cashier at Tinta to remit the public money in the provincial treasury to the Inca, assigning as a reason that it was necessary to set out forthwith to the port of Aranta,[212] threatened by a descent from English cruisers. The Inca thus received 22,000 dollars, some gold ingots, seventy-five muskets, baggage-horses, and mules. Recruits were also ordered to be embodied, and sent to Tungasuca.

Having thus drawn together a considerable force, he sent for his old master, Dr. Antonio Lopez, the Cura of Pampamarca,[213] and ordered him to make known to the corregidor that he must die, and to administer to him the consolations of religion. A scaffold was then erected in the plaza of Tungasuca, around which the retainers of the Inca were ranged in three ranks, the first armed with muskets, the second with pikes, and the rear rank with treble-loaded slings. Aliaga was then led out and publicly executed on November 10th. Tupac Amaru at the same time addressed the astonished multitude, in Quichua, as to his present conduct and ulterior views. Mounted on a fiery charger, attired in the princely costume of his ancestors, with a banner bearing the figure of an Inca encircled by embroidered chains of gold and silver, and two armorial serpents,[214] he exhorted his followers to lend an attentive ear to the legitimate descendant of their ancient sovereigns, promising to abolish the *mitas* and *repartos*, and to punish the extortionate corregidors.

The whole multitude, with one accord, vowed implicit obedience to his orders, and he at once began to form the Indians into companies, and to nominate officers. Next day he marched to Quiquijana, in the valley of the Vilcamayu, the capital of the province of Quispicanchi, which he entered at daybreak on the 12th, but the corregidor had fled. After hearing mass Tupac returned towards Tungasuca, destroying the *obraje* of Parapuquio on his way, where he found large quantities of woollen clothes, which were distributed amongst his followers. He also demolished the *obraje* of Pumacancha, where he found property valued at 200,000 dollars, consisting of 18,000 yards of woollen cloths (*bayeta*), 60,000 of cotton cloths (*tocuyo*), some fire-arms, and two pieces of artillery, belonging to the Corregidor of Quispicanchi.[215] These *obrajes* were odious to the Indians, their owners having enforced the *mita* far beyond the limits assigned by the law, and perpetrated great cruelties on the women and children of the *mitayos*. The Inca had now mustered 6000 troops, 300 armed with muskets, and the rest with pikes, clubs, and slings. Nearly the whole population of the provinces of Tinta, Quispicanchi, Cotabambas, Calca, and Chumbivilicas rose in his favour, with the exception of a few whites.

The news of Tupac Amaru's revolt was brought to Cuzco on the 12th, by Cabrera, the Corregidor of Quispicanchi, who had so narrowly escaped capture. It created the greatest alarm, as the city was only garrisoned by two regiments. The college of the

expelled Jesuits was turned into a kind of citadel, into which private and public property was taken for security; the white part of the population was enrolled; requisitions for troops were sent to the neighbouring provinces; and an express was despatched to Lima, imploring speedy succour.

Next day 450 men, under the command of Don Tiburcio de Landa, Governor of Paurcartambo, marched out of Cuzco, accompanied by the Cacique of Oropesa, Juan Sahuaraura, with 700 Indians of his *ayllu*, or tribe. Landa was ordered to wait for reinforcements at a place called Huayra-pata; but the Corregidor Don Fernando Cabrera, who accompanied him, enraged at the loss of property which he had sustained, induced him to advance to the village of Sangarara, within five leagues of Tinta, which he reached on the 17th. At dawn on the following morning it began to snow, and, finding himself surrounded by a superior force of hostile Indians, Landa retreated into the church. Tupac Amaru then wrote to him, offering terms, which were refused; and he again wrote to the cura, who was also in the church, urging him to retire with the women and children. The Spanish troops, however, prevented them from coming out, a scuffle ensued, the stock of powder ignited, and the roof and one of the walls were blown out. The Spaniards then made a dash forward, and fought bravely until they were nearly all killed.[216] Only twenty-eight wounded remained, who were cured and set at liberty by order of the Inca. Landa,[217] his lieutenant Escajadillo, Cabrera, and the Cacique Sahuaraura[218] were amongst the slain.

The news of the disaster at Sangarara reached Cuzco on the 19th, and produced indescribable confusion. The Cabildo immediately began to collect arms, make powder, repair six old field-pieces, and on the 20th Don Juan Nicolas de Lobaton y Zavala, Marquis of Rocafuerte, arrived from Urubamba with reinforcements. Every citizen came forward to serve, and a corps of volunteers was formed under Don Faustino Alvarez de Foronda, Count of Vallehermoso. The Bishop ordered all the clergy to assemble, formed them into four companies, and gave the command to the Dean, Dr. Manuel de Mendieta. More troops soon came in from Calca, under Don Pablo Astete, and from other parts, and by the end of November there were 3000 men in arms at Cuzco. Anxious to pacify the Indians, the Cabildo then issued a proclamation abolishing the *repartos*, and the *alcabala*, or excise on provisions, and declaring that the Indians should never again be forced to work in the *obrajes*, if they remained faithful. Defensive works were thrown up in the city and suburbs, and religious processions paraded the streets.

At this moment Tupac Amaru might probably have entered Cuzco without opposition; but unfortunately, relying on the justice of his cause, he beguiled himself into the belief that he could accomplish by argument and negotiation what could only be obtained by the sword. He threw up embankments and entrenched himself in an encampment near Tinta, throwing out videttes to within three leagues of Cuzco; and on the 27th he issued

an edict from his head-quarters at Tungasuca, setting forth the causes of his revolt. In this document he recapitulated the grievances which his people suffered, declared the tyranny of the Spanish officials to be impious and cruel, and called upon the Indians to rally round his standard.

Early in December 1780 Tupac Amaru crossed the Vilcañota range, by the pass of Santa Rosa, and, entering the Collao, advanced by Pucara to Lampa. At every village he addressed the people from the church-steps, saying that he came to abolish abuses and punish the corregidors; and that he was "the liberator of the kingdom, the restorer of privileges, and the common father of those who groan under the yoke of *repartos*." Nothing was heard amongst the Indians but acclamations for their Inca and Redeemer. [219] On the 13th of December he entered the town of Azangaro, where he destroyed the houses of the Cacique Chuquihuanca, who had refused to join the insurrection. A private letter, dated January 1781,[220] says that he rode into Azangaro on a white horse, with splendidly-embroidered trappings, and that two fair men, like Englishmen, of commanding aspect, were on his right and left. He was armed with a gun, sword, and pistols, and was dressed in blue velvet, richly embroidered with gold, with a three-cornered hat, and an *uncu*, in the shape of a bishop's rochet, over all, with a gold chain round his neck, to which a large golden sun was attached. Having received repeated letters from his wife, reporting the threatening assembly of troops at Cuzco, he retraced his steps, by Asillo and Orurillo, to the valley of the Vilcamayu, obliging the curas of the villages through which he passed to receive him in their churches under a canopy, and to chant the *Te Deum*.

On the 28th the heights of Picchu, overhanging Cuzco on the west, were covered with his army. His cousin Diego Tupac Amaru was detached to the eastward with 6000 men, to occupy the provinces of Calca and Paucartambo. Another detachment under Antonio Castelo, one of the Inca's most trusted followers, marched along the direct road to Cuzco, but was defeated two leagues from the city at a place called Saylla, and finally effected a junction with the main body on the heights of Picchu.

Before attempting to force his way into Cuzco, the Inca addressed a letter to the cabildo, and another to the bishop, on the 3rd of January, 1781. To the cabildo he said that, as the heir of the Incas, the ancient kings of the realm, he was stimulated to endeavour by all possible means to put an end to abuses, and to see men appointed to govern the Indians who would respect the laws of the King of Spain. The punishment of the Corregidor of Tinta was, he declared, absolutely necessary as an example to others: and he announced the object of his rebellion to be the entire abolition of *repartos*; the appointment of an *alcalde mayor*, or judge of the Indian nation, in every province; and the establishment of an *audiencia* or court of appeal at Cuzco, within reach of the Indians. "This," he concluded, "is at present the extent of my wishes, leaving to the King of Spain his former dominion." To the bishop he said that he had come forward, on behalf of the

whole nation, to put an end to the robberies and outrages of the corregidors; and he promised to respect the priests, all church property, and all women and inoffensive unarmed people.[221]

But the garrison of Cuzco had, in the mean while, been reinforced by Pumacagua, the Cacique of Chinchero, and by 200 mulatto soldiers from Lima under Don Gabriel de Aviles, who arrived by forced marches on January 1st. The cabildo, therefore, refused to entertain any proposals from the Inca. The Spaniards came out to attack him under Don Pablo Astete, and the Caciques of Chinchero and Anta, Pumacagua and Rosas. There was a long skirmish in the broken ground, which was brought to a conclusion by the evening snow; but on the 8th a sanguinary battle was fought in the suburbs and on the heights, which lasted two days, and during which a Dominican friar, named Ramon de Salazar, concealed behind a rock, did effective service with his musket, and contributed to throw the Indians into confusion. The Inca finally retreated to Tinta, to re-organize his forces.

His cousin Diego Tupac Amaru was also unsuccessful to the eastward. His division was detached from the main army at Checacupe, where he crossed some mountainous country, and again descended into the valley of the Vilcamayu, following the course of the river until he encountered the forces under the command of the Marquis of Rocafuerte, consisting of the levies of Pumacagua, Cacique of Chinchero, and those of the Caciques of Maras and Huayllabamba. An engagement took place at Huaran, on the banks of the river, near Calca, when Diego was defeated, many of his Indians being drowned in the river; and he again suffered defeat at Yucay on December 23rd. The Indian chief then left the valley of the Vilcamayu, crossed a range of mountains, and laid siege to the town of Paucartambo, on the banks of the rapid river of the same name, while his videttes hovered over the heights above the Vilcamayu valley, threatening the towns of Calca, Pissac, and Taray. Don José Antonio Vivar was sent to occupy the bridge at Urubamba, and watch the movements of the Indians. Paucartambo, and a strong fort built on a rocky height on the opposite side of the river, were desperately defended by the Spaniards under Don Lorenzo Lechuga, who had fortified and garrisoned the place. Astete was sent across the bridge at Urubamba, with 400 men, to relieve it; they had several encounters with the Indians on the march, and on reaching the besieged town they found that Lechuga had expended all his ammunition; but the besieging force, under Diego Tupac Amaru, fell back towards Tinta, on the approach of Astete, on the 18th of January, 1781. Having re-organized his army at Tinta, the Inca, accompanied by his cousin Diego, made another attack upon Paucartambo on the 11th of February; but, after several fruitless assaults, the Indian army finally retreated to Tinta on the 14th.[222]

Tupac Amaru had now assembled a force of 60,000 men in and around Tinta; but they were wholly undisciplined, and only a few hundreds were armed with muskets. All the caciques in Peru, with the exception of sixteen,[223] had, however, declared in favour of

the Inca; and the whole Indian and mestizo population, except the *ayllus* or tribes of the sixteen Hispanicized caciques, longed earnestly for the success of this truly national insurrection. After the retreat from Paucartambo in February, the Inca occupied himself in strengthening his position round Tinta, and in visiting the distant provinces of Chuquibamba and Cotabambas, while one Isidro Mamani, an Indian of ferocious character, born at Pomata, on the banks of lake Titicaca, Pedro Vargas, and Andres Ingaricona, held the open country in the Collao.

The whole of the interior of Central and Upper Peru was in revolt, and the viceroys of Peru and Buenos Ayres, Don Augustin de Jauregui and Don Juan José de Vertiz, were thoroughly alarmed. The former despatched Don José Antonio Areche, as "visitador," with extraordinary judicial powers, and a force commanded by Don José del Valle as Mariscal del Campo, to Cuzco; while the latter named Don Ignacio Flores, then Governor of Moxos, as commandante-general, to put down the rebellion in Upper Peru.

Areche, accompanied by General José del Valle, and Don Benito de la Matta Linares, a judge of the Royal Audience at Lima, arrived at Cuzco on February 23rd, 1781, where an army of 15,000 men was collected, consisting of the tribes of the recreant caciques, negroes and mulattos from the coast, and a small force of Spaniards.

Early in March General del Valle prepared to commence the campaign. But, before his army marched out of Cuzco, the visitador Areche received a letter from Tupac Amaru, in which he represented the earnest endeavours he had made to obtain justice for his people; the habitual violation of the law by the Spanish officials; the cruel and intolerable oppression caused by the *repartimentos* and the *mita*; and the absolute necessity of some reform in the administration. He concluded by proposing a negotiation by which these ends might be attained without bloodshed. This despatch is very ably written, and is a monument of the noble and enlightened views of this great but most unfortunate patriot.[224] The answer of the visitador Areche was a brutal menace, better suited to a follower of Zengis Khan than to a Christian judge. He refused all negotiation, vowed the most horrible vengeance, and concluded by saying that, if the Inca surrendered at once, the cruelty of the mode of his execution would be lessened. The Spanish General del Valle protested against the brutality of this reply.[225]

Tupac Amaru now prepared to resist to the utmost, as it became evident to him that complete independence or death were the only two alternatives which were left by the barbarous policy of the bloodthirsty visitador; but his edicts were still marked by humanity and good sense. It does not appear that he ever actually proclaimed himself a sovereign independent of Spain; yet the draft of an edict was found amongst his papers, in which he styles himself "Don José I., by the grace of God, Inca, King of Peru, Quito, Chile, Buenos Ayres, and the continents of the South Sea, Lord of the River of the Amazons, with dominion over the Grand Paytiti." The document is headed by a portrait of Tupac Amaru, crowned, with Spanish trophies at his feet. It states that the King of

Castille had usurped the crown and dominions of Peru, imposing innumerable taxes, tributes, duties, excises, monopolies, tithes, fifths; appointing officers who sold justice, and treating the people like beasts of burden. For these causes, and by reason of the cries which have risen up to Heaven, in the name of Almighty God, it is ordered that no man shall henceforward pay money to any Spanish officer, excepting the tithes to priests; but that tribute shall be paid to the Inca, and an oath of allegiance to him be taken in every town and village. The document is without date.[226]

On March 12th, 1781, the army under General del Valle marched out of Cuzco. A detachment of 2000 men was sent against the insurgents, commanded by the Caciques Parvina and Bermudez,[227] in the province of Cotabambas, who were both killed in a desperate action. Tupac Amaru used to call these brave chiefs his right and left arms. Meanwhile the main body of the royalist army advanced slowly along the mountains to the westward of the valley of the Vilcamayu, suffering much from the snow-storms, the want of food and fuel, and the shameful neglect of all commissariat arrangements by Areche. On the 18th the Inca sent a message to the Spanish General, saying that the morrow, being the festival of San José, would be an appropriate day for settling their differences; and that he should prepare his troops for a movement of which, in compliment to the name-day of both himself and Del Valle, he deemed it courteous to apprise his adversary. In consequence of this message the Spaniard kept his men under arms all night, but no attack took place, and in the morning the Inca's army was found to be gone. Tupac had intended a stratagem, and had retired into an unfrequented ravine: on the 21st a snow-storm favoured his design, and his plan would have succeeded, had not a traitor, named Zunuario de Castro, given Valle notice of his movements. The Spaniards changed their position, and the Inca passed the night in vainly searching for it.

General del Valle was upwards of seventy years of age, and, unable longer to endure the excessive cold of the mountains, he descended into the valley of the Vilcamayu, and captured Quiquijana, hanging the Cacique Luis Poma Inca, who defended it. On the 6th of April the Spanish army advanced up the valley, meeting with considerable opposition, and reached Checacupe early in the day. Near this village the Inca had taken up a position, defended by a ditch and parapet stretching across the valley, and manned by 20,000 men, but he had neglected to provide any defence for his flanks. A Spanish division stole unperceived to the back of the position, while the main body assaulted it in front; and after an heroic defence the Indians, attacked both in front and rear, fell back to another entrenched position at Combapata, a league from Tinta, where the village was surrounded by a mud wall, covered at the top with thorny bushes. The Spaniards, following up their success, played upon the village with their field-pieces for several hours, then carried the position at the point of the bayonet, and made a bloody entry into Tinta.

Tupac Amaru, with his wife and three sons, fled to Lanqui, a village about twenty miles to the westward, on the shores of a wild Alpine lake. Here he intended to have rallied his disordered troops, but he was betrayed by one of his own officers, named Ventura Landaeta, who, assisted by the cura of the place, basely delivered the illustrious Inca and his family into the hands of the Spaniards. On the same day General del Valle hung sixty-seven Indian prisoners at Tinta, whose heads he stuck on poles by the road-side. [228] Diego Tupac Amaru, his nephew Andres Mendagure, and Mariano, the second son of the Inca, fortunately escaped.

On the 8th of April Francisco, the aged uncle of the Inca,[229] was also seized, and the prisoners were marched bareheaded into Cuzco, the visitador Areche coming out as far as Urcos to meet them. They were all separated from each other, and told that they would not meet again until the day of execution.

The chief prisoners were the Inca Tupac Amaru, his wife, his two sons Hipolito and Fernando, his uncle Francisco, his brother-in-law Antonio Bastidas, his maternal cousin Patricio Noguera, his cousin Cecilia Tupac Amaru with her husband Pedro Mendagure, a number of captains in the Inca's army and other officials, and Aliaga's executioner named Antonio Oblitas,[230] a negro slave.

It is necessary to record the diabolical cruelties of the visitador Areche, and his assistant Matta Linares, in order to complete the narrative of the ill-fated Inca's life, and to show into whose hands the fate of the Peruvian Indians was placed by the Spanish viceroy, and of what devilish atrocities they were capable. On the 15th of May, 1781, the visitador Areche pronounced a lengthy sentence, in which he declared that it was necessary to hasten its execution, in order to convince the Indians that it was not impossible to put a man of such elevated rank to death, merely because he was the heir of the Incas of Peru. He then accused the Inca of rebellion, of destroying the *obrajes*, of abolishing the *mita*, and of causing pictures to be painted of himself dressed in the imperial insignia of the *uncu* or mantle, and *mascapaicha* or head-dress; and others representing the triumph of his arms at Sangarara. He condemned his victim to behold the execution of his wife, his son, his uncle, his brother-in-law Antonio Bastidas, and of his captains; to have his tongue cut out, and afterwards to have his limbs secured to the girths of four horses dragging different ways, and thus to be torn in pieces. His body to be burnt on the heights of Picchu, his head to be stuck on a pole at Tinta, one arm at Tungasuca, the other in Caravaya, a leg in Chumbivilicas, and another in Lampa. His houses to be demolished, their sites strewn with salt, all his goods to be confiscated, all his relations declared infamous, all documents relating to his descent to be burnt by the hangman, all dresses used by the Incas or caciques to be prohibited, all pictures of the Incas to be seized and burnt, the representation of Quichua dramas to be forbidden, all the musical instruments of the Indians to be destroyed, all signs of mourning for the

Incas to be forbidden, all Indians to give up their national costumes, and dress henceforth in the Spanish fashion, and the use of the Quichua language to be prohibited.

In the annals of barbarism there is probably not to be found a document equalling this in savage wickedness and imbecile absurdity: and this was written by a Spanish judge only eighty years ago.[231]

This hideous cruelty was literally carried into effect, in all its revolting details. On Friday the 18th of May, 1781, after the great square had been surrounded by Spanish and negro troops, ten persons came forth from the church of the Jesuits. One of these was the Inca Tupac Amaru, who had, in the early morning, been visited in prison by Areche, and urged to betray all the accomplices in his rebellion.[232] "You and I," he replied, "are the only conspirators: you for having oppressed the country with exactions which were unendurable, and I for having wished to free the people from such tyranny." [233] The Inca's companions in misfortune were his wife Micaela, his sons Hipolito and Fernando, his brother-in-law Antonio Bastidas, his uncle Francisco Tupac Amaru, Tomasa Condemaita the Cacica of Acos, José Verdejo and Andres Castelo, captains in the Inca's army, and the executioner Oblitas.

Verdejo, Castelo, Oblitas, and Bastidas were hung at once. The rest were heavily chained, tied up in the bags which are used for carrying the maté or Paraguay tea, and dragged backwards into the centre of the square by horses. Francisco and Hipolito Tupac Amaru, the one an old man verging on fourscore years, the other a youth of twenty, then had their tongues cut out, and, with Tomasa Condemaita, were garrotted by an iron screw, the first that had been seen in Cuzco. Micaela, the wife of the Inca, was then placed on the same scaffold, her tongue was cut out, and the screw was placed round her neck in presence of her husband; but she suffered cruelly, because her neck was so small that the screw failed to strangle her. The executioners then placed a lasso round her neck, and pulled different ways, at the same time kicking her in the stomach and bosom until they succeeded in killing her. The Inca was then taken into the centre of the square, his chains were taken off, and his tongue was cut out. He was then thrown on the ground; lassos, secured to the girths of four horses, were fastened to his wrists and ankles, and the horses were made to drag different ways, "a spectacle never before seen at Cuzco." As the unfortunate Inca's body was thus raised into the air, his youngest son Fernando, a child of ten years, who had been forced to witness this horrible massacre of his relations, uttered a heartrending shriek, the knell of which continued to ring in the ears of those who heard it to their dying day.[234] The horses did not pull at the same time, and the body remained suspended like a spider for many minutes, until at last the brutal miscreant Areche, who was looking on from a window in the College of the Jesuits, caused the head to be cut off.[235] The child Fernando was then passed under the scaffold, and sentenced to be banished for life to one of the penal settlements in Africa.

Many of the Spanish citizens were present, but not an Indian was to be seen. They afterwards declared that, while the horses were torturing the Inca, a great wind arose, with torrents of rain, and that even the elements felt the death of the Inca, whom the inhuman and impious Spaniards were torturing with such cruelty.[236]

The heads, bodies, and limbs of the victims were sent to the different towns of Peru, and to the villages round Cuzco,[237] in order to strike terror into the hearts of the Indians; but this proceeding of course had the opposite effect, and goaded them to fury. By the humane exertions of the Inca the war had hitherto been carried on without unnecessary bloodshed, and he had always protected unarmed persons and women; but, after the perpetration of these barbarities in Cuzco, it became a war of extermination, and during the following year not less than 80,000 people fell victims to the vengeance of the Indian and Spanish troops.

In the revolting cruelty of Areche may be traced the abject terror of a dastardly and craven mind; and to this cowardice may also be imputed the concessions which were afterwards wrung from him.[238] Tupac Amaru did not die in vain; for, after the suppression of his revolt, the *repartos* were abolished, and the *mitas* were much modified.

Thus fell the last of the Incas. He was a man of whom his nation might well be proud, and will bear comparison with the greatest monarchs of his race. Having enjoyed the best education which Spanish policy at that time permitted to the people of the colonies, he brought a cultivated mind, a clear understanding, untiring industry, and devoted zeal for the welfare of his countrymen to his important duties as a wealthy and influential cacique. When he afterwards undertook the office of defender of the oppressed Indians he displayed an amount of patient perseverance, combined with great ability in the advocacy of their cause, which excited the admiration of the Bishop of Cuzco and others of the more enlightened Spaniards. Finally, after he had unwillingly become convinced that all remonstrance was useless, he, in his appeal to arms, combined promptitude of action with great moderation in his demands; his edicts were remarkable for their good sense and humanity; and had his efforts been met by the Spaniards in a corresponding spirit, the viceroy of the King of Castille might at length have succeeded in enforcing the practical observance of the humane laws of his master.

But this was not to be. Instead of a calm and enlightened statesman, and Spain had many such, the viceroy placed full powers in the hands of a wretch whose conduct was a mixture of cowardice, atrocious cruelty, and incapacity. Fortune decided in favour of the Spaniards, and the Inca fell into the power of a man whose vile nature was excited to acts of unequalled barbarity by the terror which his position and his incompetence had caused him. I have felt obliged to relate the shocking circumstances of the death of Tupac Amaru in justice to the Indians; for who can be surprised if afterwards they frequently refused to give quarter to any of the hated race of *Chapetones*, as they called

the Spaniards? and no atrocity was ever perpetrated by them which can be compared to the execution of the Inca and his family, committed by the deliberate sentence of a Spanish judge.[239]

CHAPTER X.

DIEGO TUPAC AMARU—FATE OF THE INCA'S FAMILY—INSURRECTION OF PUMACAGUA.

WHILE the events occurred in the valley of Vilcamayu which ended in the capture of the Inca Tupac Amaru and his family, the whole of the Collao was in a state of insurrection, and all Spaniards had to escape for their lives to Puno, La Paz, or Arequipa.

Don Joaquim Antonio de Orellana,[240] Governor of Puno, made a most gallant defence of that town, with a force consisting of 180 musketeers, 647 pikemen, 44 artillerymen with 4 guns, and 254 cavalry. He retreated behind his entrenchments when the Inca advanced as far as Lampa, in December 1780; but in February 1781, in spite of the heavy rains, he marched to Lampa, where he flogged an Indian until he confessed that his rebel countrymen were on an adjacent mountain called Catacora. Orellana found the rebel army drawn up in an almost inaccessible position, with colours flying; and, while seeking for a place where his troops might ascend, they suffered from a storm of hail and snow. The Spaniards were divided into two assaulting parties, but the showers of stones which the Indians hurled from their slings obliged them to retreat, and Orellana himself was wounded in the jaw.

He found it prudent to fall back towards Puno, and, on the 16th, encamped on the banks of the river of Juliaca, near a place called Mananchili. The Indian army followed the Spaniards and offered them battle—the chiefs sending a message to Orellana to tell him that they acknowledged no king but their Inca Tupac Amaru. They formed their forces in a semicircle—the right being led by the Cacique Andres Ingaricona, the left by Mamani, and the centre by a chief of Caravaya named Alejandro Calisaya. The battle began at four P.M., and, after a sharp fight, Mamani's division fled to the adjacent heights, and Ingaricona was also routed. The Indians left 370 killed on the field; among whom there were many women who came to fight by the sides of their husbands and brothers, armed with bones sharpened at one end. Notwithstanding this success, Orellana made a rapid retreat to his entrenched position at Puno, collected provisions, and sent messengers to Arequipa for reinforcements.[241]

On the 18th of March the Indian army came in sight, extending for three miles along the heights round Puno, with colours flying and a great noise of drums and clarions, entirely surrounding the town, except on the side of the lake. It was commanded by the Caciques Andres Ingaricona and Pedro Vargas. The dismal news of the capture of Tupac Amaru reached the besieging Indians on April 12th, when they retreated, followed by a Spanish force under Nicolas de Mendiosala of Chucuito. He overtook them posted on a hill

called Condorcuyo, to the left of the road to Cuzco, when a furious struggle commenced; but the Indians fought most gallantly, and defeated Mendiosala, who retreated in disorder. This success encouraged the rebels as much as it disheartened the Spaniards, and Chucuito and the other towns on the western banks of the lake of Titicaca fell into their hands. They committed indiscriminate slaughter in revenge for the cruel death of the Inca, and only a few Spaniards escaped to Puno. The governor Orellana sent balsas to rescue some fugitives who were concealed in the rushes on the shores of the lake, he himself being confined to his house[242] by a wound in his foot. Meanwhile the Indians of Azangaro, by capturing the town and peninsula of Capachica, completed the conquest of the province of Chucuito, and the rebel chiefs prepared for a second siege of Puno.

Diego Cristoval Tupac Amaru the Inca's cousin, with his nephew Andres Mendagure, Mariano the young son of the Inca, and Miguel Bastidas a nephew of the Inca's wife, escaped when the rest of their family were betrayed and captured at Lanqui. They now joined the rebel army in the Collao, Diego took the command, and on the 9th of May he invested Puno on all sides, and commenced the second siege.

The Indians were formed in a semicircle on the sides of the surrounding hills; while Orellana had deepened his entrenchments, and occupied a very strong position on the Huassa-pata hill, above Puno: he also built two forts, one called Santa Barbara, where the triumphal arch now is, and the other called Horca-pata, on the descent from the heights of Cacharani. The corners of the plaza and of the streets were barricaded. On the 10th there were skirmishes all day, and on the 11th the Indians carried the forts of Santa Barbara and Horca-pata by assault, and penetrated into the streets, but failed in their attack on the rocky height of the Huassa-pata.[243] On the 12th the besiegers suddenly retreated, at the approach of the army advancing from Cuzco.

General del Valle, after defeating the Indians at Combapata, continued his march up the valley of the Vilcamayu, crossed the pass of Ayaviri, and, entering the Collao, advanced towards Puno, where he arrived in the middle of May. But the Indians of his army were disgusted at the excessive rigour with which the rebels were treated; they deserted in great numbers,[244] and assisted the troops of Diego Tupac Amaru in harassing the Spaniards, and cutting of all supplies. The army of del Valle had been shamefully neglected by the visitador Areche, who was too busy in torturing his prisoners to attend to the commissariat. The troops were wretchedly clad, unpaid, without medical stores, or biscuit, or fresh meat. Under these circumstances the General reluctantly determined to retreat to Cuzco, taking with him the garrison and inhabitants of Puno, which place was evacuated by Orellana on the 26th of May. The army which had left Cuzco in March 15,000 strong was now reduced, by desertions and sickness, to 1443 men, with which force General del Valle commenced the retreat, closely followed and constantly harassed by the Indians. He reached Cuzco on the 4th of July, when a paper war ensued between him and Areche, the latter blaming him for evacuating Puno, while the General

retorted that Areche had shamefully neglected the wants of his army, and failed to make any attempt to subdue the country round Cuzco.[245]

The Viceroy seems to have taken the part of the General in this controversy; and the foul vulture Areche, with his companion Matta Linares, was recalled. He reached Lima on August 23rd, 1781, and embarked for Spain with the poor little Fernando, son of Tupac Amaru, who was sentenced to imprisonment for life.

The Indians still remained in arms round Cuzco, especially in the heights above Urubamba and Calca, and at Lauramarca and Ocungate. Those near Calca fortified themselves in a place called Chayña-ccasa, against whom the General sent a force of 400 men under Don José de Barela, and the Indians were defeated with great slaughter; while Don Joaquim Balcarcel kept the insurgents in check, who continued to threaten Paucartambo.

After the retreat of General del Valle from Puno, Diego Tupac Amaru established his head-quarters at the town of Azangaro, while Andres Mendagure and Miguel Bastidas overran the provinces on the eastern shore of lake Titicaca, captured the town of Sorata, and placed themselves in communication with the insurgent forces in Upper Peru. It is said that fifteen mule-loads of treasure, consisting of spoils from the provinces of Omasuyos and Larecaja, were brought into Azangaro at this time and buried. Diego Tupac Amaru occupied a house near the plaza, where he gave audience in a long sala; and he went from this house to the church every night, wrapped in a large cloak. This story made people believe that he was concealing treasure, and many a fruitless search has since been made for it.[246]

The hopes of the Indians were now beginning to wane. Diego, though a man of considerable talent, was not possessed of the same influence over the people as his unfortunate cousin; and the Spanish officials were rapidly receiving reinforcements from Buenos Ayres, while the slaughter of the Indians had been prodigious. In August, 1781, Diego issued a decree, ordering that all women, children, and priests, should be respected during the war;[247] and on the 18th of October he promulgated a manifesto setting forth the numerous violations of law habitually committed by the corregidors, the exactions of the curas, and the extortionate duties imposed by the aduaneros.[248] This is a very able and telling document, and, together with the more detailed writings of the unfortunate Inca, forms a most complete vindication of this memorable insurrection.[249]

On September 12th, 1781, the viceroy of Peru, Don Augustin de Jauregui, had issued a proclamation offering pardon, on submission, to Diego Tupac Amaru and all his followers.[250] It would swell this short narrative to an undue length if I attempted to give any account of the events in Upper Peru during this period;[251] but the final suppression of the revolt in that part of the country by the Spanish commanders Flores, Reseguin, and Segurola, induced Diego Tupac Amaru to accept the Viceroy's offer of

pardon, give up the cause, and place himself in the power of a faithless enemy. Dr. Antonio Valdez, cura of Sicuani, the friend of the Inca, and author of the Quichua play of 'Ollantay,' was sent to Azangaro by the Spanish authorities to persuade Diego to adopt this course. They held their conferences on the subject while walking up and down on the banks of the river; and there is a tradition that Pedro Vilca Apasa, one of Diego's bravest officers, overheard one of these conversations, and remonstrated violently against the madness of trusting to the word of a Spaniard. But the advice of Valdez prevailed, Diego sent young Miguel Bastidas to open a negotiation with the Spanish Colonel Reseguin in November; and on December 11th he gave himself up to Don Ramon de Arias, commandant of the column of Arequipa. At the same time Mariano Tupac Amaru, the son of the Inca, Andres Mendagure, and Miguel Bastidas, surrendered to Don Sebastian de Segurola at La Paz. Bastidas was sent to Buenos Ayres.

Diego Tupac Amaru received his pardon at Sicuani, from General del Valle in the name of the viceroy, on January 26th, 1782; and on the same day the Bishop of Cuzco[252] solemnly absolved him in the church. But Vilca Apasa, Alejandro Calisaya, and other chiefs of Diego's army, refused to submit, and continued in arms in the provinces of Caravaya and Azangaro. General del Valle marched against them in March 1782, and took most of them prisoners. Vilca Apasa was captured in his native village of Tapa-tapa, eighteen miles east of Azangaro, where his descendants still live. He was torn to pieces by horses in the plaza of Azangaro, and his limbs were stuck on poles by the road-side.[253] An old lady told me that she could remember seeing one of his arms on a pole near her father's house. Calisaya, and many others, were hung. The Spanish General had the cruelty to force Diego Tupac Amaru to accompany him, and to witness the execution of his old friends. Del Valle then marched over the cordilleras of Lauramarca and Ausangate, where the Indians had been in rebellion, taking Diego with him in a sort of triumph, and returned to Cuzco in August. The old general was taken ill soon afterwards, and died at Cuzco on the 4th of September, leaving the command of the troops to Don Gabriel de Aviles.

Diego Tupac Amaru was permitted to retire to Tungasuca; and young Mariano Tupac Amaru, with his cousin Andres Mendegure, lived at Sicuani. But it would appear that the Spanish authorities had no intention of keeping their faith with these unfortunate Indians, and it was soon seen that the distrust of Vilca Apasa was but too well founded. The Spaniards were only waiting for an excuse before they completed the extirpation of the whole family of the Incas. This was soon found in a rebellion of the Indians of Marcapata and Lauramarca, who, on the approach of a force under the Corregidor Necochea in January 1783, retired to the lofty and almost impenetrable heights of Hapo and Ampatuni. In February their leader, Santos Huayhua, was captured with his family, and torn to pieces by horses.[254]

Thus the desired excuse for treachery and faithlessness was furnished. All the surviving members of the family of the Inca Tupac Amaru were arrested, by order of the viceroy of Peru.[255] The accusations against them were frivolous, and, so far as appears in the sentences, without a shadow of proof to support them. Diego was accused of calling the Indians his sons, of living in a way unbefitting a pardoned rebel, and of performing funeral rites for his cousin the Inca; young Mariano Tupac Amaru of rescuing his lady-love on September 9th, who had been forced to become a novice in the monastery of Santa Catalina in Cuzco; Andres Mendagure of conducting himself in a suspicious way; Manuela Castro, the mother of Diego, of keeping up disaffection amongst the Indians; and Lorenzo and Simon Condori, the brothers-in-law of Diego, of assisting the rebels in Marcapata. The rest of the family were accused of being relations.

Diego was imprisoned with his kindred on the 15th of April, 1783, by Don Raymundo Necochea, Corregidor of Quispicanchi;[256] while Mariano Tupac Amaru and Andres Mendagure were sent to Lima, put on board a ship, butchered at sea, and their bodies thrown overboard. The vulture Matta Linares, who was still an Oidor of the Audienica at Lima, scented carrion from afar, and arrived at Cuzco on April 20th, with the same extraordinary judicial powers as had previously been given by the viceroy to Areche. On the 17th of July he sentenced Diego Tupac Amaru to be dragged at the tail of a mule, with a rope round his neck, to the place of execution in the plaza of Cuzco, there to be hung and quartered, his body and limbs to be distributed amongst the towns of Tungasuca, Lauramarca, Paucartambo, and Calca, his goods to be confiscated, and his houses destroyed; his mother, Marcela Castro, to be hung and quartered, and her body to be burnt in the plaza; Lorenzo and Simon Condori to be hung; and Manuela Titu Condori, the wife of Diego, to be banished for life.[257] These sentences were executed on the 19th of July 1783; and Matta Linares obliged the good cura of Sicuani, Dr. Valdez, by whose persuasion, as the ancient friend of the Inca Tupac Amaru, Diego had been induced to accept the treacherous pardon, to witness the executions.[258] Matta Linares is still remembered in Cuzco for his barbarous, immoral, and sneaking conduct. He died in Spain in about 1818, having been one of the first among the unworthy Spaniards who declared in favour of Joseph Buonaparte.

At about the time of Diego's execution, the last spark of insurrection was trampled out in Huarochiri, a province in the Andes near Lima. The Indians of the villages near Caramporna had risen under one Felipe Velasco Tupac Inca Yupanqui, who declared that the Inca was not dead, but that he was alive and crowned in the "Gran Paytiti."[259] Don Felipe Carrera, who had been appointed Corregidor of Parinacochas, was sent to Huarochiri, and by a rapid march succeeded in capturing the chief. Towards evening, however, he was surrounded by a large body of Indians armed with slings and poles, in a narrow and dangerous part of the road. He retreated to an eminence with his prisoner, where he defended himself until dark against the storm of stones, and then escaped to

Lima. After daily fights with the Indians the rebellion was put down in June, 1783. Felipe Velasco, and his lieutenant Ciriaco Flores, were hung in the great square of Lima on July 7th, 1783.[260]

Having, after two years and a half, succeeded in quelling the insurrection, it remained for the viceroy to extirpate all the innocent members of the family of the Incas, and all who were connected with them by marriage. Ninety members of the family were sent to Lima in chains, among whom were Bartolomé Tupac Amaru, the venerable great-uncle of the Inca; Marcela Pallocahua, the mother of the Inca's wife Micaela Bastidas; and Manuela Condori, the wife of Diego. Soon after his arrival at Lima Bartolomé Tupac Amaru died at the extraordinary age of 125. A life of temperance had given this aged prince the strength to endure months of solitary confinement at Cuzco, to sustain blows from muskets and staves in the plaza, to undergo a cruel journey on foot and in chains of 400 miles, but the horrors of the Lima prison at length killed him. The unhappy survivors were shipped off at Callao, in two ships, the 'Peruana' and the 'San Pedro,' and thrown into cells in Cadiz for three years, when Charles III. caused them to be distributed, apart from each other, in prisons in the interior of Spain, until their sufferings were relieved by death. Once during the voyage they were allowed by the brutal captain of the transport 'Peruana,' named José Cordova, to wash their tattered clothes at Rio; but their fetters were never removed, and, though the captain gave his word of honour to a Frenchman who mended his damaged rudder, that he would take them off, he unblushingly perjured himself; and the horrors which were suffered by these innocent persons, many of them aged women and young children, were never relaxed until they arrived at Cadiz.[261]

Fernando, the youngest child of the Inca, "whose shrill cry smote every heart with electric sympathy"[262] when he beheld the cruel tortures of his parents, was taken to Spain by the visitador Areche in 1781. He was then only ten years of age. In 1783 one Don Luis Ocampo, a citizen of Cuzco, went to Spain, and heard that young Fernando was a close prisoner in the castle of San Sebastian at Cadiz. Through the aid of an Irish gentleman, who was intimately acquainted with the town major, Ocampo applied for a pass to visit him, but was refused. He, nevertheless, made his way into the fort, and, looking round at the iron gratings of the cells, at length caught sight of a youth whose countenance bespoke his origin. He addressed him in Quichua, and found that he was speaking to Fernando Tupac Amaru. While talking to him Ocampo received a blow from the butt end of the musket of a Swiss sentry, whom, however, he induced to permit him to continue the conversation. It appeared that the government allowed Fernando six rials a day, but that the soldiers of the guard cheated him of half. Ocampo gave him two or three dollars a week during his stay in Cadiz; and this is the last we know, for a certainty, of the last surviving child of the unfortunate Inca.[263]

The fate of these poor Indians, the remaining descendants of those Incas of Peru whose remarkable civilization, and great power and wealth, became a proverb during the sixteenth century, will not fail to be interesting to those who have become acquainted, through the pages of Robertson, Prescott, or Helps, with the history of the Spanish conquest of Peru. The sufferings and death of Tupac Amaru and his family form a very sad story, yet they did not suffer and die in vain: and it must be recorded of them that, unlike other dispossessed families, they sacrificed themselves, not for their own selfish ends, but in the hope of serving their people. They did not die in vain, for in their fall they shook the colonial power of Spain to its foundation. Not only was the system of *repartos* at once abolished, and the *mitas* considerably modified, but in 1795 the hated office of corregidors was replaced by that of intendentes, and from the cruel death of the last of the Incas may be dated the rise of that feeling which ended in the expulsion of the Spaniards from Peru.

The rebellion which broke out in Cuzco, thirty-four years after the death of Tupac Amaru, is historically important, not on account of the patriotism of its leaders, for they were almost all men of small weight and selfish ends, but because the great body of the Indians rose as one man at the first signal, in the hope of freeing their country from a foreign yoke. In 1809 the people of Upper Peru had formed an independent government, which they called an "Institucion de Gobierno," and the viceroy sent General Goyeneche against them with 5000 men from Cuzco. The rebels, ill-provided with arms, were defeated at Huaqui, near lake Titicaca, and slaughtered without mercy;[264] but General Pezuela, who succeeded Goyeneche in the command, had to face a patriot army from Buenos Ayres under Belgrano, which kept him fully employed. Then it was that the opportunity was seized of commencing a rebellion at Cuzco; and this enemy in the rear of the royal army placed Pezuela in a most critical position.

The leader of the rebellion was Mateo Garcia Pumacagua, Cacique of Chinchero near Cuzco, then a very old men. In January 1781, when Tupac Amaru occupied the heights of Picchu above Cuzco, he had marched from Chinchero with Indians to join him, but, hearing that a large Spanish army was advancing from Lima, he changed his mind, and took part against his countrymen with such zeal, that the viceroy created him a brigadier in the Spanish service. On August 3rd, 1814, this Indian Cacique Pumacagua, with the three brothers Vicente, Mariano, and José Angulo, Don Gabriel Bejar, Hurtado de Mendoza, Astete, Pinelo, Prado, and others, raised the cry of independence in Cuzco; and so unanimous was the feeling against Spanish rule, that the whole population of that city joined heart and soul in the insurrection.[265] The brothers Angulo were men of low birth, and vulgar both in their language and their persons;[266] but Astete and Prado were gentlemen of good family and position. It is possible that they made use of Pumacagua, as an Indian cacique, that his countrymen might more readily be induced to join their cause.

Having occupied Cuzco, the insurgents divided their forces into three divisions, which separated in different directions, to excite the other provinces to revolt. Mariano Angulo, Bejar, and Mendoza, who was nicknamed Santafecino, marched to Guamanga, assaulted the house in which several Spaniards had taken refuge, and hung two officers in the plaza. Colonel Vicente Gonzalez was sent against them from Lima, and attacked the insurgents, who had been joined by a body of Morochuco Indians, near Guanta, in September. The rebels were defeated, and several Morochuco Indians were shot at Guamanga, but the country continued in a disordered state until Santafecino was finally routed at Matara in April 1815.

Pinelo, and the cura of Munecas in Upper Peru, entered Puno without resistance with another division on August 29th, advanced to La Paz, and took it by assault after a siege of two days, on September 24th.

The main division, led by Pumacagua in person, and Vicente Angulo, marched on Arequipa.

The position of the royalist army under Pezuela, with the Buenos Ayrean army of independence in front, and this formidable insurrection in the rear, was most critical: for the Indians, believing that the rule of their Incas was to be restored, and that Pumacagua would succeed where Tupac Amaru had failed, were flocking in thousands to the standard of the old cacique. Pezuela organized a division of his army, 1200 strong, commanded by General Don Juan Ramirez, who marched from Oruro in October, and fell upon the rebels, numbering 4000 men, 500 armed with muskets, and the rest with slings, who were encamped on the heights above La Paz. The rebels retired in good order to Puno, and Ramirez entered La Paz, and, having extorted 63,000 dollars from the citizens, continued his march to Puno, which he occupied on November 23rd, and pressed on towards Arequipa on the 26th.[267]

In the mean while Pumacagua and Angulo had been joined by many caciques with their *ayllus* or tribes, and he organized his army at Cavanilla, giving the rank of generals and colonels to the Indian chiefs.[268] From Cavanilla the rebel forces marched along the road from Puno to Arequipa, descended the "alto de los huesos," and encountered the Spanish troops under Brigadier Picoaga in the plain of Cangallo. Picoaga was defeated and taken prisoner, and the Indians entered Arequipa in triumph, where the greatest enthusiasm prevailed for the cause of independence. Picoaga and Moscoso, the Intendente of Arequipa, were shot by order of the Angulos, who, early in December, issued a proclamation, declaring that Peru was free; that there had been a revolution in Lima; and that the viceroy Don José de Abascal was in prison. These falsehoods were intended to excite the Spanish Americans to revolt; but, indeed, they required no such stimulus, for the people of all races and classes were burning to throw off the yoke of Spain.

It was at this time that Melgar, the enthusiastic young poet of Arequipa, joined the national army, and became secretary to Vicente Angulo.

On the approach of Ramirez, Pumacagua evacuated Arequipa, and manœuvred for some days on the lofty plains between Apo and the post-house of Pati. Ramirez steadily advanced, and came in sight of the Indian army at a little hut called Chillihua, near the head of the "alto de los huesos;" but Pumacagua, avoiding a battle, retreated hastily into the interior, and Ramirez entered Arequipa without opposition on December 9th. His first act was to shoot Don José Astete, and other patriots who had compromised themselves during the time that Pumacagua was in the city.

The enthusiasm of the Indians was so great that, notwithstanding the affair at Chillihua, which one authority describes as a retreat,[269] and another as a disastrous defeat,[270] they again flocked to the standard of the old cacique at Pucara, where he soon had another undisciplined half-armed force around him, numbering 40,000 men. Ramirez organized a force at Arequipa of 1200 men armed with muskets, and fifty dragoons; and, commencing his march on February 11th, 1815, he encamped round the town of Lampa on March 1st. On that day he received a letter from Vicente Angulo, protesting against the war being carried on in a savage and relentless spirit, representing that, when a whole people rises in arms, the insurgents ought to be granted belligerent rights; and urging the duty of concluding the war by negotiation, and not by bloodshed. "It is not fear," Angulo continues, "that induces me to write thus, but a feeling of humanity."[271] Ramirez answered that he would accept nothing but unconditional surrender. On March 4th he advanced to Ayaviri, on the Vilcañota range, which separates the Collao from the valley of the Vilcamayu. Here he received a letter from Pumacagua. The cacique asked the Spanish general for whom he was fighting, seeing that Ferdinand VII. had been sold to the French, and that no man knew where he had been taken to; he declared that there was now no other king but the caprice of Europeans, and that, therefore, he desired to establish a national Government; and he told him that he was ready to meet the Spanish army on the field of battle.[272] Ramirez replied that a general of the king's army would not waste words with vile and insolent rebels, and that his bayonets would soon make them alter their tone.[273]

From the 6th to the 10th of March both armies marched in parallel lines, separated by the rivers Umachiri and Ayaviri. On the 10th Pumacagua drew up his army behind the river Cupi, which was much swollen by the rains. He had 30,000 men, of whom 800 only were armed with muskets, and forty field-pieces, said to have been cast at Cuzco by an Englishman named George ——,[274] some of them of very large calibre, with which he annoyed the Spaniards during the night before the battle. Ramirez had only 1300 men; but they were all disciplined and well-armed soldiers. He crossed the river Cupi, near Umachiri, in spite of opposition; charged and dispersed the Indians, killing a

thousand men, and captured all their cannon. The rout was complete, and the chiefs of the patriot army sought safety in flight.[275]

The poet Mariano Melgar was taken prisoner, and immediately shot on the field of battle. The fate of this young man was very melancholy: an unrequited passion led him to join the desperate cause of the insurgents, and he is now chiefly remembered by his melancholy love-songs and *despedidas*.[276]

Ramirez, immediately after the battle of Umachiri, marched to Cuzco, where he arrived on the 25th; but he detached a portion of his troops in pursuit of the Indians, who were again defeated close to the town of Azangaro. The Spaniards cut off the ears of all their prisoners, flogged them cruelly, and sent them to tell their comrades that they would be treated in the same way unless they instantly laid down their arms. The Indians fled over the hills, followed by the Spaniards, who again defeated them on a hill near Asillo, six leagues to the north. Amongst the prisoners at Asillo were the mutilated Indians who had been sent to terrify the rest, still bravely fighting against their tyrants. Of such heroism is the usually meek and docile Indian capable.[277]

After the battle of Umachiri, Pumacagua had escaped to the heights of Marangani; but he was betrayed by an Indian whom he had sent down to buy some food, and brought a prisoner into Sicuani. After a sort of confession had been extorted from him, he was hung, not even with a respectable halter, but with a lasso, being seventy-seven years of age. José, Mariano, and Vicente Angulo, Gabriel Bejar, and many others were shot at Cuzco by Ramirez, who, in the following June, again united his forces with those of General Pezuela, in Upper Peru. Thus ended the last great rising of the Indians under one of their own chiefs, after a campaign which lasted ten months.

Ten years after the death of Pumacagua every Spanish soldier had been driven out of the country. Peru was independent, and the Indians received equal rights with citizens of Spanish descent in the new Republic, at least so far, and only so far, as the law could give them. The *mita* or forced labour was entirely abolished in 1825; but the tribute or capitation-tax continued to be exacted until 1854 in Peru, and is still the principal source of revenue in Bolivia, the Upper Peru of Spanish times. It is not, however, quite exact to suppose that this tribute was a capitation-tax; it was practically at least a rent or tax on the produce of the land, and more resembled the land-tax of India. The tribute was levied on every male between the ages of eighteen and fifty; but, in point of fact, nearly every individual between those ages cultivated his own piece of land, or shared the produce of a larger piece with several others. Latterly the tribute paid by each Indian generally amounted to five dollars a year; but, in some villages, the Indians paid double that amount, the exact rule being handed down by tradition, and known to the caciques. Those who paid most enjoyed a more dignified position. The department of Puno yielded 300,000 dollars; that of Cuzco, 400,000. The entire abolition of the tribute by General Castilla in 1854 is a portion of that mad and reckless system of finance by

which the revenue of Peru is made to depend almost exclusively on the yield of guano from the Chincha Islands.

In Bolivia the tribute is still paid by men between the ages of eighteen and fifty: the amount being six to ten dollars a year for proprietors of land, and five dollars for strangers. The revenue from this source amounted, in 1850, to 4,595,000 dollars.

But though the *mita*, the *reparto*, and the tribute have all been abolished by law in Peru, the deplorable civil wars, and the system of keeping up a large standing army, which is not only unnecessary, but most mischievous, have entailed much oppression on the Indians in the shape of impressment for the army. Villages are frequently surrounded by a party of soldiers, and all the able-bodied men that can be caught are driven away to serve in the ranks. This deplorable waste of human life is rapidly reducing the already scanty population; and the system is more oppressive and cruel because it is done in defiance of the law, by the military presidents and generals who have hitherto been able to set the laws enacted by civilians at defiance, when it suits their purpose.[278] Yet on the whole the condition of the Indians is immeasurably more endurable under the Republic than it was when they groaned under the *mitas* of the Spanish corregidors.

The history of these Peruvian Indians has been a very melancholy one. The early accounts which the Spanish chroniclers gave of the great empire of the Incas represented the Indians as a people ruled by laws and usages which provided for almost every action of their lives; neither a thief nor a vicious man was known amongst them; and they lived in happiness and contentment, but under a most rigid system of tutelage and subjection. Then came the Spanish conquerors, and, after a quarter of a century of bloodshed and rapine, the people found themselves bowed down by a grievous yoke. While the most beneficent laws were enacted by the Council of the Indies, their humane provisions continued to be either entirely evaded, or converted into pretexts for additional modes of oppression. From upwards of thirty millions the population was reduced to three millions within the space of two centuries; and all that can be said of the much-lauded colonial legislation of Spain is that it prevented the Indians from being actually exterminated; and that, when Peru gained her independence, there were a few million survivors, scattered in villages at wide intervals over a region once thickly peopled by their ancestors. The Council-room at Seville was, like another place, thickly paved with good intentions.

I was thrown a great deal amongst the Indians, and at one time I had the most excellent opportunities of judging of their character, and I was certainly most favourably impressed. They now have many vices engendered by centuries of oppression and evil example, from which their ancestors were probably free: they are fond of chicha and aguardiente, and are very suspicious; but I found that this latter feeling disappears when the occasion for it is found not to exist. They have had but too good reason for their suspicion generally. On the other hand, they are intelligent, patient, obedient, loving

amongst each other, and particularly kind to animals. Crimes of any magnitude are hardly ever heard of amongst them; and I am sure that there is no safer region in the world for the traveller, than the plateaux of the Peruvian cordilleras. That the Indians are not cowardly or mean-spirited when once roused was proved in the battles which they fought under the banner of Tupac Amaru in 1781; and a people who could produce men capable of such heroic constancy as was displayed by the mutilated heroes of Asillo should not lightly be accused of want of courage. When well led they make excellent soldiers.

Although there is so large a proportion of *mestizos*, or half-castes, in Peru, it is very remarkable how isolated the Indians still remain. They have their separate language, and traditions, and feelings, apart from their neighbours of Spanish origin; and it is even said that there are secret modes of intercourse, and even secret designs amongst them, the knowledge of which is guarded with jealous care. In 1841, when General Gamarra was at Pucara, on his way to invade Bolivia, it was reported that certain influential Indians, from all parts of the country, were about to assemble in the hills near Azangaro, for the discussion of some grave business; and that they were in the habit of assembling in the same way, though in different localities, every five years. The object of these assemblies was unknown—it may have been merely to converse over their ancient traditions—but it was feared, at the time, that it was for some far deeper and more momentous purpose. It is believed that similar meetings have since taken place near Chayanta[279] in Bolivia, near Quito, and in other parts, but the strictest secrecy is preserved by the Indians themselves. The abolition of the tribute has probably had the effect of separating the Indians still more from the white and mixed races, for they used to have constant intercourse connected with the payments to the authorities, which brought them into the towns, while now they live apart in their solitary huts in the mountain fastnesses, or in distant villages.

It may be that this unhappy people, descendants of the once mighty race which, in the glorious days of the Incas, conquered and civilised half a continent, is marching slowly down the gloomy and dark road to extinction; "the fading remains of a society sinking amidst storms, overthrown and shattered by overwhelming catastrophes."[280] But I trust that this may not be so, and that a fate less sad is still reserved for the long-suffering gentle children of the Sun.

CHAPTER XI.

JOURNEY FROM PUNO TO CRUCERO, THE CAPITAL OF CARAVAYA.

On April 7th we left Puno on the road to the chinchona forests of Caravaya. There are three modes of travelling in Peru: one by purchasing all the required mules and employing servants; the second, by hiring an *arriero*, or muleteer, who supplies the mules at so much for the journey; and the third, by using the wretched animals which are provided at the post-houses, and changing them at each stage, but this can only be done on the main roads. The latter way, though the least comfortable, is by far the most economical, and I therefore determined to adopt it, yet I should probably have hesitated had I known the trouble it would entail. I bought a fine mule for a hundred dollars, with the gentle *paso llano*, the easiest pace imaginable, for myself, and sent to the post-house at Puno for beasts for Mr. Weir, the gardener who accompanied me, and for the baggage. Four vicious-looking brutes accordingly made their appearance, and we started; but no sooner had we reached the plain at the top of the zigzag path leading out of Puno to the north, than they all ran away in different directions, kicking violently. After hours of this kind of annoyance I at last got one of the brutes into a corner of a stone-fenced field, but, just as I was about to catch him, he gave a kick, jumped over the wall, and went off again. It ended in our having to drag the mules by their lassos until our arms were nearly torn out of the sockets; and thus we ignominiously entered the village of Paucar-colla late in the evening, a distance of only twelve miles from Puno. As for the scenery, or the nature of the country, between Puno and Paucar-colla, I can remember nothing but vicious mules with their hind legs kicking up in the air.

Paucar-colla is built on an eminence, surrounded by broad grassy plains, which slope down to the shores of the lake of Titicaca. It consists of a few streets of mud-built, red-tiled huts, ranged round a large plaza, with a church in a dilapidated state, also of mud. At this place I saw the last of the Aymara Indians, or at least of their women, who can always be distinguished by their dress, which differs from that worn by the Inca or Quichua Indians. The Aymara women wear an *uncu*, or garment brought together over each shoulder, and secured in the mode of the classic Greeks, with two *topus*, or large pins, generally in the shape of spoons. The head-dress is a curiously-shaped, four-cornered red cap, the sides curving outwards and stiff, with black flaps suspended from it, sometimes hanging down, and at others thrown up over the top. The Quichua dress, used by the women from here as far as Cuzco, is quite different: they have a full woollen skirt, reaching down half-way between the knee and ankle; a bright-coloured *lliclla*, or mantle, over the shoulders, secured across the bosom by a single *topu*; and as a head-dress the broad-brimmed black velvet *montero*, with red and blue ribbons.

I left Paucar-colla early next morning, and passed by several fields of *quinoa* (Chenopodium quinoa), the harvest of which was just beginning. The stalks are cut and tied up in heaps, and then the grain is beaten out with sticks. It is used by the Indians in their universal dish, the *chupe*, and in various other ways; but it is an insipid and not very nutritious grain. Just beyond the village there is a stream called the Illpa, which, in the dry season, scarcely wets the mules' hoofs; but at this time of year it was swollen into a broad river, and it was necessary to cross it on reed balsas, with the luggage, while the mules swam. A very large troop of mules, laden with aguardiente, was passing over at the same time—a long and tedious business. There are many streams crossing these roads, which are swollen during the rainy season, and very serious delays are thus caused for want of a few bridges. From the Illpa to Caracoto there is a broad plain extending to the shores of the lake, with the town or village of Hatun-colla on one of the last spurs of the cordillera to the west.[281] This wide expanse, in the rainy season, is swampy and half submerged. It was covered with flocks and herds, with huts and out-buildings scattered over it, and surrounded by mud walls. Here and there we passed pretty little cow-girls and shepherdesses, now dressed in the Quichua, not the Aymara, costume. Some of these little maidens, as they stood by the wayside spinning wool, had such pretty faces, with the rosy colour showing through their soft, brown skins, and their figures were so graceful and dignified, that they strongly reminded me of the pictures of young Inca princesses in the churches of Santa Anna, and of the Jesuits, at Cuzco:—

"La vi tan fermosa
Que apenas creyera
Que fuese vaquera
De la Finojosa."

Potatoes, quinoa, and barley were cultivated in the skirts of the hills bordering on the plain.

The village of Caracoto is at the extreme end of a long rocky spur, running out across the plain; a street of neat mud huts, with a plaza and dilapidated church. At the post-house a child had died, which was set out on a table with candles burning before it, and the friends of the postmaster were holding a wake, singing, fiddling, and drinking. Between Caracoto and the next village of Juliaca there is another swampy plain: most of the road was under water, and we encountered a heavy hail-storm. The lights and shades on the cordilleras and nearer hills, the heavy black masses of cloud in one part of the heavens, and the sun's rays breaking through in the other, were very fine. Juliaca is a small town built under a spur of the mountains, with a handsome stone church. It was Easter-Sunday, and I was invited to meet all the principal families at dinner at the house of the cura. Several Indian alcaldes were in attendance; consequential old

fellows in full dress, consisting of broad-brimmed black felt hats, sober-coloured ponchos, and black breeches very open at the knees, no stockings, and *usutas* or sandals of llama-hide. The distinctive mark of the alcaldes, of which they are very proud, is their staff of office, with silver or brass head and ferule, and rings round it according to the number of years the owner has held office. The Indians here wear the hair in numbers of very fine plaits reaching half-way down their backs. An Indian always accompanied the post-mules from one village to another, in order to take back the return-mules; and at Juliaca, while I was quietly enjoying the cura's hospitality, the Indians took my own mule back to Caracoto, as well as the post-mules. Next morning, therefore, I sent for it, and received an answer that the postmaster knew nothing about it. I was eventually obliged, after seeing the gardener and luggage on their way to Lampa, to go back to Caracoto, where the postmaster was drunk and insolent; and at length I found it, with a troop of others, on the great plain beyond Caracoto. Several Indians took much trouble for me in catching my mule; and it was late in the afternoon before I got back to Juliaca, and was ready to set out on my journey to Lampa. I mention this incident in order to show the trouble and inconvenience of acting as one's own muleteer, although such a mode of travelling is certainly four or five times as cheap as hiring an arriero; and I may add that the travelling by post-mules caused me incessant annoyance and trouble. Whenever they saw a chance the vicious brutes always ran off the road in different directions, bumped their cargo against rocks, and tried to roll, keeping us constantly employed in galloping after them, and greatly increasing the fatigues of the journeys. On several occasions, too, an animal was provided which was so weak or tired that it sank under its cargo before it had gone a league, and obliged me to return to the post-house for another. The adjustment and lashing of the cargos, like everything else, requires considerable knack and skill, which is only acquired by experience; the Indians were as ignorant in such matters as we were; and during the first three or four journeys our troubles were increased by the cargos constantly slipping on one side, when the mules always seized the opportunity of rushing off the road and kicking furiously.

A few miles north of Juliaca there is a large river, formed by the junction of those of Lampa and Cavanilla, the latter being the same which rises in the lake on the road between Arequipa and Puno, and flows by the post-house of La Compuerta. We crossed it in a reed balsa while the mules swam. Beyond the river is the great plain of Chañucahua, which was covered with large pools of water, at this season frequented by ducks and sandpipers. Close under the mountains, which bound it on every side, were a few sheep-farms, one of them the property of Don Manuel Costas of Puno, and the sheep roamed at will over many leagues of pasture-land. At the northern extremity of the plain the road ascends and descends a range of steep hills, and, turning a rocky spur, I came in sight of the town of Lampa. It was just sunset; the tall church-tower rising over the town, and a stone bridge spanning the river, were clearly defined by the crimson glow in the

western sky, while the lofty peaked mountains forming the background were capped by masses of black threatening clouds. At that moment a tremendous thunder-storm, with flashes of forked lightning and torrents of rain, burst over the town.

Lampa is the capital of a province in the department of Puno, and I was hospitably received by the Sub-prefect, Don Manuel Barrio-nuevo, who occupied a good house in the plaza. A portion of the army of the South was quartered in the town; and the General came every evening to have tea with the Sub-prefect and his lady, a handsome Arequipeña. On these occasions the party consisted of General Frisancho and several officers, and ladies who came attended by their little Indian maids, carrying shawls, and squatting on the floor in comers during the visit. After tea and conversation the company generally sang some of the *despedidas* and love-songs of their national poet Melgar, in parts; and one young lady sang the plaintive *yaravis* of the Indians in Quichua.

The church of Lampa is a large building of stone, dating from 1685, with a dome of yellow, green, and blue glazed tiles, of which I was informed there was formerly a manufactory in Lampa. The tower is isolated, and about twenty yards from the church, apparently of a different date. Rows of Indian girls, in their gay-coloured dresses, were sitting in the plaza before their little heaps of chuñus, ocas, potatoes, and other provisions, amongst which, at the season of Easter, there are always great quantities of herbs gathered on the mountains, possessing supposed medicinal virtues. Among these a fern, called *racci-racci*, is used as an emetic; *churccu-churccu*, a small wild oxalis, is taken as a cure for colds; *chichira*, the root of a small crucifer, for rheumatism; *llacua-llacua*, a composita, for curing wounds; *quissu*, a nettle, used as a purgative; *cata-cata*, a valerian, as an antispasmodic; *tami-tami*, the root of a gentian, as a febrifuge; *quachanca*, a euphorbia, the powdered root of which is taken as a purgative; *hama-hama*, the root of a valerian, said to be an excellent specific against epilepsy;[282] and many others, the native names of which, with their uses, were given me, but I was unacquainted with their botanical names. Generally when the name of a plant is repeated twice in Quichua it denotes the possession of some medicinal property.

On the morning of our departure from Lampa the ground was covered with snow, which was slowly melting under the sun's rays. Immediately after leaving the town the path winds up a steep mountain range called Chacun-chaca, the sides of the precipitous slopes being well clothed with *queñua*-trees (*Polylepis tomentella*, Wedd.), which are gnarled and stunted, with dark-green leaves, and the bark of the trunk peeling like that of a yew. Their sombre foliage contrasted with the light-green tufts of *stipa*, and the patches of snow. The pass was long and dangerous, with little torrents pouring down every rut; and on its summit was the usual *pacheta*, or cairn, which the Indians erect on every conspicuous point. The path descends on the other side into a long narrow plain, with the hacienda of Chacun-chaca on the opposite side. The buildings are surrounded by queñua-trees, and in their rear two remarkable peaked hills rise up abruptly, clothed

with the same trees, with ridges of rock cropping out at intervals. Their sides were dotted with cattle, tended by pretty little cow-girls, armed with slings, and some of them playing the *pincullu*, or Indian flute. The plain was covered with long grass, in a saturated and spongy state, and groves of queñua-trees grew thickly in the gullies of the mountains on either side. After a ride of several leagues over the plain, latterly along the banks of the river Pucara, I turned a point of the road, and suddenly came in sight of the almost perpendicular mountain, closely resembling the northern end of the rock of Gibraltar, which rises abruptly from the plain, with the little town of Pucara nestling at its feet. The precipice is composed of a reddish sandstone, upwards of twelve hundred feet above the plain, the crevices and summit clothed with long grass and shrubby queñuas. Birds were whirling in circles at a great height above the rock, which, in the Spanish times, was famous for a fine breed of falcons, which were carefully guarded and regularly supplied with meat. They tell a story at Pucara that one of these birds was sent to the King of Spain, and that it returned of its own accord, being known by the collar.

Pucara means a fortress in Quichua; and here Francisco Hernandez Giron, the rebel who led an insurrection to oppose the abolition of personal service amongst the Indians, was finally defeated in 1554. The town is a little larger than Juliaca, with a handsome church in the same style, and a fountain in the plaza. I dined and passed the evening with the aged cura, Dr. José Faustino Dava, who is famous for his knowledge of the Quichua language, in its purest and most classical form. The fame of Dr. Dava's learning, in all questions connected with the antiquities of the Incas and the Quichua language, had reached me in England, and I was glad to obtain his valuable assistance in looking over a dictionary of the rich and expressive language of the Incas, on which I had been working for some time.

Owing to the diminution of the aboriginal population in Peru, and the constantly increasing corruption of the ancient language, through the substitution of Spanish for Quichua words, the introduction of Spanish modes of expression, and the loss of all purity of style, that language, once so important, which was used by a polished court and civilized people, which was spoken through the extent of a vast empire, and the use of which was spread by careful legislation, is now disappearing. Before long it will be a thing that is past, or perhaps fade away entirely from the memory of living generations. With it will disappear the richest form of all the great American group of languages, no small loss to the student of ethnology. With it will be lost all the traditions which yet remain of the old glory of the Incas, all the elegies, love-songs, and poems which stamp the character of a once powerful, but always gentle and amiable race.

Unlike the English in India, the half-Spanish races of Peru have paid little attention to the history and languages of the aborigines, within the present century; and, if left to them, all traces of the language of the Incas, and of the songs and traditions which

remain in it, would, in the course of another century, almost entirely disappear. A few honourable exceptions must, however, be recorded. The late Mariano Rivero paid much attention to the antiquities of his country, and the results of his labours have been published at Vienna.[283] The curas of some of the parishes in the interior, also, especially Dr. Dava of Pucara, Dr. Rosas of Chinchero, and the Cura of Oropesa, near Cuzco, are excellent Quichua scholars, but they are very old men, and their knowledge will die with them.

Dr. Dava had a large collection of the finches, and other birds of the loftier parts of the Andes, hanging in wicker cages along the wall of his house. Amongst them were a little dove called *urpi*; the bright yellow little songster called *silgarito* in Spanish, and *cchaiña* in Quichua; the *tuya*, another larger warbler; the *chocclla-poccochi* or nightingale of Peru; and a little finch with glossy black plumage, pink on the back, and whitish-grey under the wings. He also had some small green paroquets, with long tails and bluish wings, which make their nests under the eaves of roofs, at a height of fourteen thousand feet above the sea. At Pucara some of the inhabitants have small manufactories for making glazed earthenware basins, pots, plates, and cups,[284] which find an extensive market in the villages and towns of the department of Puno, and which will probably long hold their own against the same kind of coarse wares from Europe or the United States.

From Puno to Pucara I had travelled along the main-road to Cuzco; but, at the latter place, I branched off to the eastward, to pass through the province of Azangaro to that of Caravaya. The main-road continues in a northerly direction, crosses the snowy range of Vilcañota near Ayaviri, and descends the valley of the Vilcamayu to Cuzco. At Pucara I left post-houses and post-mules behind me, for they only exist on the main-roads between Arequipa, Puno, Cuzco, and Lima; henceforth I had to depend on being able to induce private persons to let out their mules or ponies to me.

About 500 yards from the town of Pucara is the river of the same name, which flows past Ayaviri in the mountains of Vilcañota. It was very full, and eighty yards across. The mules swam, and we had to cross in a rickety balsa made of two bundles of reeds, which had to go backwards and forwards five times before all the gear and baggage was on the eastern side. After riding over a plain which became gradually narrower as the mountains closed in, I began the ascent of a rocky *cuesta*, with a torrent dashing down over huge boulders into the plain. There was a splendid view of the distant rock of Pucara, with the snowy peaks of the Vilcañota range behind. A league further on there was an alpine lake, with a fine peaked cliff rising up from the water's edge. There were many ducks and widgeons, and large coots were quietly busy, swimming about and building their nests on little reed islands; also jet-black ibises, with dark rusty red heads and long curved bills. After a ride of several leagues over a grassy country covered with flocks of sheep, I reached the summit of a range of hills, and got a distant

view of the town of Azangaro, in a plain with several isolated steep grassy mountains rising from it, and the snowy Andes of Caravaya in the background. After a very wearisome descent I reached the plain, and, riding into Azangaro, was most hospitably and kindly received by Don Luis Quiñones, one of the principal inhabitants.

The region which I had traversed between Puno and Azangaro is all of the same character—a series of grassy plains of great elevation, covered with flocks and herds, and watered by numerous rivers flowing into lake Titicaca, which are traversed by several mountain-ranges, spurs from the cordillera, which sometimes run up into peaks almost to the snow-line, and at others sink into rocky plateaux raised like steps above the plain. What strikes one most in travelling through this country is the evidence of the vast population it must have contained in the days of the Incas, indicated by the ruined remains of *andeneria*, or terraces for cultivation, rising in every direction tier above tier up the sides of the hills. But it is now almost exclusively a grazing country, and the Indians, employed in tending the large flocks of sheep, only raise a sufficient supply of edible roots for the consumption of their families, and the market of the nearest town. Frequently the shepherds are what are called *yanaconas*, or Indians kept to service by the owners of the flocks, which vary from 400 to 1000 head. The condition of this class of Indians is very hard, as they get only a monthly allowance of an *arroba* of chuñu (frozen potato) or quinoa, and a pound of coca, or four dollars a month in money.

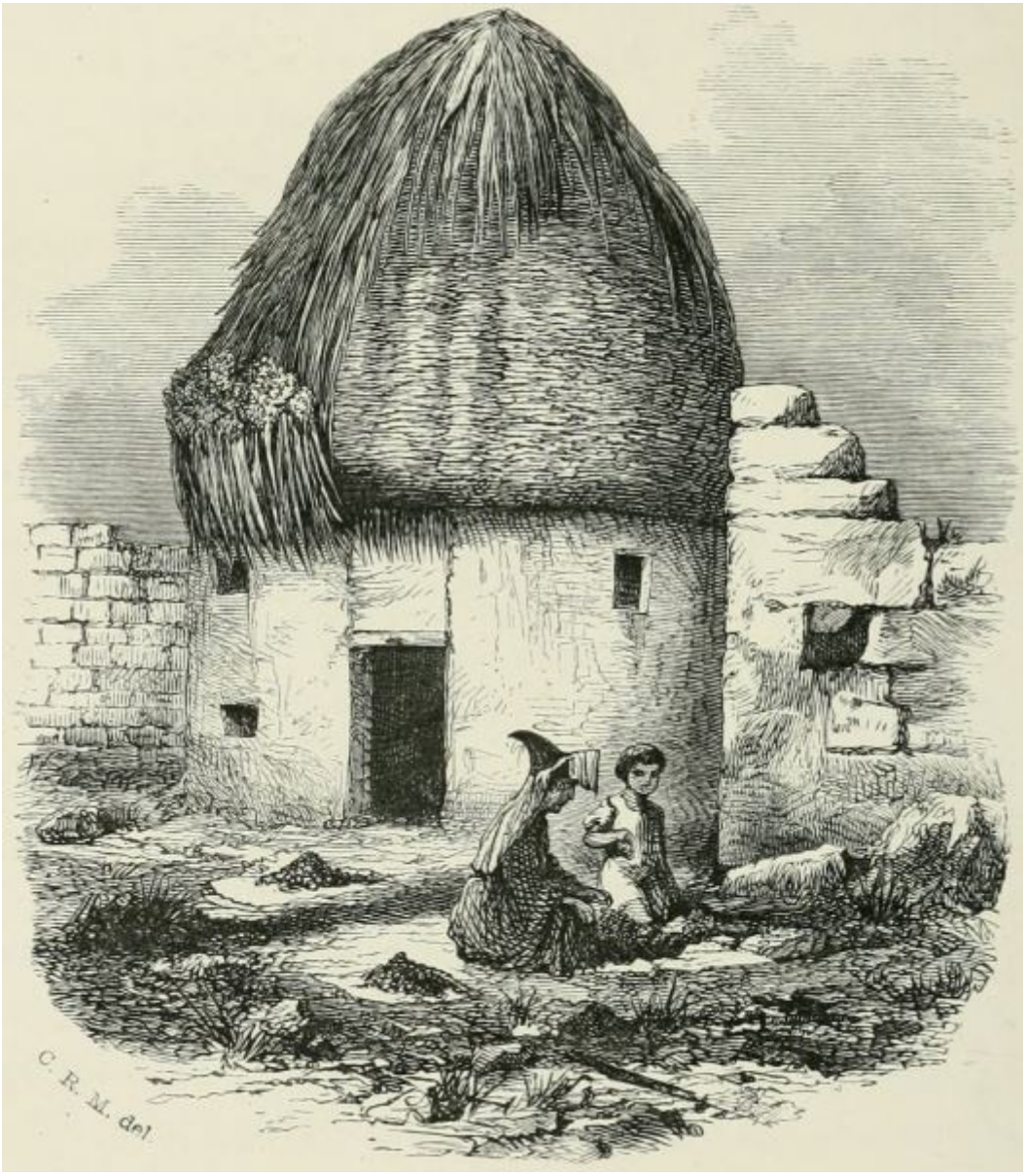
Puno, Juliaca, Lampa, Pucara, and Azangaro, are all between 12,800 and 13,000 feet above the sea. Between March 28th and April 15th, the indications of the thermometer at these places were as follows:—

Mean temperature	52½°
Mean minimum at night	37¼
Highest observed	58
Lowest	37
Range	21

Azangaro is the capital of the province of the same name. There is a tradition that, when the Indians were bringing gold and silver for the ransom of the Inca Atahualpa, they received news of his murder by Pizarro, at Sicuani, and at the same time orders came from Inca Manco, who was at Cuzco, to remove the treasure to a greater distance; and that they buried it near this town. *Asuan* is "more," *carun* "distant;" hence *Azangaro*. It is generally believed that this treasure, worth 7,000,000 dollars, as well as the fifteen mule-loads of church-plate brought into the town by Diego Tupac Amaru in 1781, are concealed somewhere, and that some of the Indians know the place well, but will not divulge it. Hence there have been numerous attempts to discover it, and one sub-prefect made several excavations under the pavement in the church, but without any success. On one occasion, not long ago, an old Indian, who had been a servant in the house where

Diego Tupac Amaru lodged, told the sub-prefect that in the centre of the *sala*, after digging down for about two feet, a layer of gravel from the river would be reached; a little further down a layer of lime and plaster; a little further a layer of large stones; and that beneath the stones would be the treasure. The excavation was commenced, and great was the excitement when all the different layers were found exactly as the Indian had described them; but there was no treasure. It is not unlikely that the Indian only knew or only told half the clue; and that these layers were some mark, whence a line was to be measured in some particular direction, and to a certain distance, to denote the spot under which the treasure was deposited. Yet the searches have not been wholly unsuccessful. There are several subterranean passages and chambers under Azangaro, and one was discovered a few years ago which had been made by the Indians in ancient times. It led towards the plaza, and ended in a recess, where there were several mummies, adorned with golden suns and armlets, and golden semispheres covering their ears—now the property of my host, Don Luis Quiñones.

Azangaro is *par excellence* the city of hidden treasure. The houses are built of mud and straw, and thatched with coarse grass (*stipa ychu*), the better sort being whitewashed. To the north of the town there is a long ridge of rocky heights; to the south an isolated peaked hill nearly overhangs the town; to the east is the river; and to the west is a plain bounded by the mountains towards Pucara. The church, in the plaza, is like a large barn outside, with walls of mud and straw, and a tower with broad-brimmed red-tiled roof; but on entering it I was astonished at its extraordinary magnificence, so entirely out of proportion to the wealth or importance of this little town. The nave is lined with large pictures on religious subjects, by native artists, in frames of carved wood richly gilt. The elaborate gilded carving was very striking; the leaves, bunches of grapes, and twisted columns, being the workmanship of the famous carvers of Cuzco. Over the arch leading to the chancel there is a picture representing the Triumph of the Faith, in bright colours. The high altar is plated with massive silver, with gilded columns, pictures, and images, in gorgeous profusion up to the roof. On either side are two very remarkable pictures, filling the walls between the altar and the chancel-arch. On the right an allegorical picture, and the Shepherds worshipping. One figure, in the latter picture, a girl holding a basket on her head, is of great merit, and exactly resembles the 'Santa Justa' of Murillo in the Duke of Sutherland's collection. On the left is a picture of the 'Woman taken in Adultery,' and an excellent copy of the well-known 'Worshipping of the Magi,' by Rubens, in the Madrid gallery. In a side chapel there is a copy of Leonardo da Vinci's 'Last Supper,' with portraits of two caciques—the heads of the two great families of Azangero—with their wives, one of them very pretty, looking on in a corner. These copies, which are excellent, must have been procured from Europe at very great expense.



THE SONDOR-HUASI, AT AZANGARO.

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The author of all this magnificence, according to the inscription on his portrait, which is fixed in a handsome gilt frame by the side of the chancel arch, was the Bachiller Dr. Don Basco Bernardo Lopez de Cangas, a native of Cuzco, and Cura of Azangaro. The interior decorations were completed on January 12th, 1758, and the cura died in 1771. He must have been possessed of enormous wealth, to have enabled him thus to beautify and adorn his church with such lavish profusion.

In the days of the Incas the two great families of Azangaro, whose heads ranked as Curacas, were the Murumallcucalcinas and Chuquihuancas; and they retained the office of cacique until recent Spanish times. The Murumallcucalcina family is now extinct: they lived in the town, and a portion of their house still remains, called the *Sondor-huasi*, dating from the time of the Incas, and the greatest curiosity in the place. It is a

circular building, about twelve feet in diameter, with walls twelve feet high, of mud and straw, very strong and thick. The dome-shaped roof of thatch also dates from the time of the Incas. The outside coating consists of a layer of *stipa ychu*, two feet thick, placed in very regular rows, and most carefully finished, so as to present a smooth surface to the weather. Next there is a thick layer of the same grass placed horizontally, netted together with reeds; and finally an inner perpendicular layer; the whole thatch being five feet thick. The interior framework consists of twelve perfect circles of bent wands, with others descending in curves from the apex of the roof to the crest of the wall, and where they cross there are lashings of a tough reed. The whole is finished with most admirable neatness, forming a perfect dome. This is the only roof of the time of the Incas still remaining in Peru, and hence its great importance in an antiquarian point of view. It has been said that the colossal and highly-finished masonry of the Incas, and their poor thatched roofs, formed a barbaric contrast; but the Sondor-huasi proves that their roofs rivalled their walls in the exquisite art and neatness of their finish. The Sondor-huasi is now in a very dilapidated state, and is used as a kitchen by the degenerate collateral heirs of the old caciques.

The Chuquihuanca family had a country house about a league from Azangaro, which was destroyed by the army of Tupac Amaru in 1780, because the Chuquihuancas deserted their countrymen and adhered to the Spanish cause. I accompanied Don Luis Quiñones, and the whole of the society of Azangaro, to a picnic at the ruined house of the Chuquihuancas; and it was amusing to see all the masters of families, the Sub-Prefect Don Hipolito Valdez, the judge, the cura, and every one else, locking the great folding-doors leading into their *patios*, and putting the keys into their pockets. Azangaro was entirely deserted. We were all well mounted, and there were fourteen young ladies of the party, fresh pleasant girls, who thoroughly enjoyed a good gallop. The ruined house was in a corner of the plain, and surrounded on three sides by steep overhanging cliffs. There are the remains of a house, with a long corridor of brick arches, behind which several broad terraces rise up the face of the cliff, which are still ornamented with some fine *oliva silvestre* and *queñua* trees, a few ancient apple-trees, and a dense growth of bright-yellow Compositæ, and Solanums with a purple flower. A noisy torrent foamed down the cliffs and over the terraces to the plain below. It was a very pretty spot, but in a most desolate condition, and many small doves made their nests in the trees. Lupins (*ccerra*[285]) and nettles (*itapallu*) were growing in the crevices of the rocks. We had an excellent and very merry dinner; a large amount of Moquegua wine, and of the better-clarified and more generous liquor from Don Domingo Elias's vineyards at Pisco, were drunk; and guitar-playing and samocueca-dancing finished the day's entertainment. We returned to Azangaro after dark. Don Luis assured me that the people of this little town were like one family; and that, though election-time or periods of civil dissension sometimes caused estrangement amongst them, the habitual concord and friendship always returned when the excuse for alienation had passed away.

Azangaro is a great cattle-breeding province, and there is a considerable trade in cheeses with Arequipa and other parts. I found very great difficulty in procuring animals to enable me to continue my journey. At length I succeeded in hiring four miserable-looking, vicious, undersized ponies; and, having crossed the Azangaro on balsas, by far the largest river I had passed over since leaving Puno, the way led over the rocky range of Pacobamba hills into another plain, where there were several cattle and sheep farms; and the village of Corruarini, consisting of a ruined church and a dozen huts. The river Azangaro rises in the snowy mountains of Caravaya, forms an immense curve of nearly half a circle in a course of about two hundred miles, and, uniting with the river of Pucara, falls into the lake of Titicaca as the river Ramiz, the largest of its affluents. After a ride of six leagues we reached the little village of San José, under a conical hill, and close to the snowy mountains of Surupana.

I dined with the cura, Fray Juan de Dios Cardenas, who gave me a list of medicinal herbs used in Azangaro; and the beasts from that place were so infamous that I was obliged to invoke his assistance to procure fresh ones. It appeared that two Frenchmen had passed a few days before, on their way to establish a saw-mill in the Caravaya forests, with a view to floating timber down the river of Azangaro to lake Titicaca, and that they had ill-treated some Indians. It was thus very difficult to induce them to furnish ponies, but the alcaldes, with their great hats and long sticks, were summoned, and, after some negotiation, they were induced to supply four ponies to go as far as Crucero, the capital of the province of Caravaya. It was most fortunate that I was enabled to do this, for, during the night, the owners of the Azangaro ponies came out to San José, and stole them, so that we should have been left without even this wretched means of conveyance.

From San José the path winds up a long ravine for several leagues, down which a torrent dashes furiously over the rocks, descending from the snowy peak of Accosiri. The mountain scenery, consisting of steep grassy slopes, masses of rock, torrents, and distant snowy peaks, was very fine. The ravine led up to the summit of the pass of Surupana, where it was intensely cold, and the height of which I roughly estimated, with a boiling-point thermometer, at 16,700 feet above the sea. Here I met an active young vicuña-hunter, well mounted, and provided with a gun, who said he was a servant of the Cacique Chuquihuanca of Azangaro, on his way to buy wool in Caravaya. He continued in my company during most part of the day. Loud claps of thunder burst out in different directions, and a snow-storm was drifting in our faces. The ravines were covered with deep snow, between high dark mountains, with abrupt cliffs cropping out. A flock of vicuñas dashed across our path, disappearing again in the driving sleet. After wading through snow and mud for several leagues the weather cleared up, and we began to descend a splendid gorge, exactly like some of the finest coombs on the north coast of Devon, on a gigantic scale. This led us down into a valley, where I parted with my young vicuña-hunter, who had been a very pleasant companion. Riding down the grassy valley, and passing many flocks of sheep, I rode through the village of Potoni, a dozen

huts on the side of a hill; forded the river Azangaro, which is here but a small stream even in the rainy season; and riding up the opposite bank, got a magnificent view of the snowy mountains of Caravaya, with their sharp needle-like peaks. Two leagues brought me to Crucero, the capital of the province of Caravaya, so called from the cross-roads which here branch off to the various villages in the forests on the other side of the snowy barrier which rises up close to the town, to the eastward.

Crucero is a collection of comfortless mud-houses, with a small dilapidated church in the plaza, on a very elevated swampy plain. It was intensely cold, with heavy snow-storms during the nights, and the people sat wrapped up in cloaks without fires, shivering in a dreary helpless way, and going to bed soon after sunset, as the only comfortable place. I was most kindly received by the sub-prefect, Don Pablo Pimentel, a veteran soldier, and an official who had served many years at the head of the Government in Caravaya, and in Lampa. Dr. Weddell had named a new genus of chinchonaceous plants *Pimentelia*, in honour of the worthy old sub-prefect, which had pleased him very much. I remained a few days in Crucero, before setting out for the chinchona-forests in the valleys of Sandia and Tambopata; and during that time I obtained a good deal of information from Don Pablo Pimentel, and from Señor Leefdael the Judge, respecting the province of Caravaya. Don Pablo had travelled over almost every part of it; and I also received much information at Arequipa from Don Agustin Aragon, a former sub-prefect, who has a large estate in the Caravaya forests. From these sources I am enabled to offer some account of those parts of Caravaya which I did not visit, and which will form the subject of the following chapter. Caravaya is a region of which little is known to European geographers, and, so far as I am aware, no traveller has yet given any account of it to the English public.

Puno to	Paucar-colla	9	miles.
"	Caracoto	18	"
"	Juliaca	6	"
"	Lampa	21	"
"	Pucara	27	"
"	Azangaro	16	"
"	San José	18	"
"	Crucero	36	"
		151	"

CHAPTER XII.

THE PROVINCE OF CARAVAYA.

A short Historical and Geographical Description.

THE Peruvian province of Caravaya is drained by streams which form part of the system of one of the largest and least known of the tributaries of the Amazon—the river Purus.

The Purus is the only great affluent flowing into the Amazon from the south, the course of which has never yet been explored. We have detailed accounts of the Huallaga from Maw, Smyth, Poeppig, and Herndon; of the Ucayali from Smyth, Herndon, and Castelnau; and of the Madeira from Castelnau and Gibbon; but of the Purus, the largest apparently, and one which, in course of time, will probably become the most important, we have next to nothing. Its mouth, and the course of its tributaries, near the base of the Andes, are alone described.

Condamine and Smyth, in descending the Amazon, mention the great depth and volume of water at the mouth of the Purus: Herndon heard from a Brazilian trader at Barra, who had ascended its stream for some distance, that it was of great size, and without obstructions; and Haënke, in the last century, arguing from reliable geographical data which he had collected from Indians, stated his conviction that a very large river, flowing from the Andes east of Cuzco, reached the Amazon to the westward of the mouth of the Madeira.

This is the sum of our knowledge of the mouth and lower course of the Purus. The tributaries which flow into it drain the eastern slopes of the Andes, from the latitude of Cuzco quite to the frontier of Bolivia—that frontier dividing the streams flowing into the Purus, on the Peruvian side, from those which feed the Beni, on the Bolivian. These affluents of the Purus are divided into three distinct systems: the furthest to the north and west, consisting of the streams flowing through the great valley of Paucartambo, which unite under the name of the Madre de Dios, or Amaru-mayu; the middle system, draining the ravines of Marcapata and Ollachea; and the southern and eastern, being the numerous rivers in the province of Caravaya, as far as the Bolivian frontier, which unite as the Ynambari. The Madre de Dios and Ynambari together form the main stream of the Purus.

The Paucartambo system is the only one which has, as yet, been described by modern explorers. In Spanish times the streams which compose it were explored, and farms of cacao and coca were established on their banks; and in the end of the last century an expedition was sent to explore the course of the Madre de Dios, under an officer named

Don Tiburcio de Landa. This must have been at some time previous to 1780, for Landa was killed in that year in the great rebellion of the Indians under Tupac Amaru.[286] After the declaration of Peruvian independence, General Gamarra, the first Republican Prefect of Cuzco, sent an expedition to protect the farms in the valley of Paucartambo from the encroachments of the wild Chuncho Indians, and to explore the Madre de Dios. It was commanded by a Dr. Sevallos, now a very old man, retired to a farm in the Caravaya forests, but he has, unfortunately, lost his journal. General Miller made an expedition into the same region in 1835, and penetrated to a greater distance than any other explorer before or since. A very brief account of his journey was published in the 'Royal Geographical Society's Journal' for 1836; but there is a much fuller and most interesting journal kept by this gallant veteran, which has never been printed. In 1852 Lieut. Gibbon, U.S.N., entered the valleys of Paucartambo; and in 1853 I explored a part of the course of its principal stream, the Tono.[287] Another expedition to explore this region, under the sanction and with the aid of the Peruvian Government, was undertaken by some native adventurers, accompanied by a few Americans, and an English artist named Prendergast, in 1856, but it completely failed. Since that time the wild Chuncho Indians have continued to attack and encroach upon the few farms which existed in these valleys at the time of my visit in 1853, and at the present moment there is not one remaining. The rich valleys of Paucartambo, once covered with flourishing cacao and coca farms, have again become one vast uncultivated tropical forest.

Following the eastern slopes of the Andes to the south and east, we next come to the streams which drain the valleys of Marcapata and Ollachea, but of these very little is known. These valleys are in the province of Quispicanchi, in the department of Cuzco; and it is said that in times past they were cultivated with advantage, and contained many coca farms. In the beginning of the last century a Jesuit found gold in a hill called Camante, in the Marcapata valley, situated between two ravines, in one of which, called Garrote, a Spanish company established gold-washings. The leading man of this company, named Goyguro, employed hundreds of Indians, and extracted gold from the Camante hill in lumps; but one day an immense landslip fell into the Vilca-mayu,[288] the chief stream of Marcapata, and all the workmen ran away, and could not be induced to return. This was in about the year 1788.

For forty years after this event coca-farms and gold-washings were alike abandoned in Marcapata, until in 1828 the cura of the village of that name, Dr. Pedro Flores, again opened a road into the valleys, and, with some associates, established several farms for raising coca and fruit. In 1836 a company was formed by several young adventurers, the chief of whom were José Maria Pacheco of Cuzco and José Maria Ochoa[289] of Huara, with the object of again discovering the long-lost golden hill of Camante. The party assembled at Ocongate, in the cold region of the Andes, whence the distance to Marcapata, at the commencement of the warm valleys, is fourteen leagues over a bad

road, which traverses the cordillera of Ausungate and Pirhuayani. From Marcapata the two adventurers Pacheco and Ochoa, both active and intrepid young men, advanced into the forests with fourteen Indians, and a stock of chuñus and dried meat. These explorers penetrated for several leagues, following the course of the Vilca-mayu, but their expedition led to no practical results.[290] In 1851 Colonel Bologenesi became the manager of an expedition for collecting chinchona-bark in the forests of Marcapata, and proceeded to the scene of his labours, accompanied by a young Englishman named George Backhouse. They advanced into the forests until they fell in with parties of wild Chuncho Indians, who were propitiated by presents of knives and other trifles, and induced to assist young Backhouse and his party in collecting bark. Some of the Chunchos, however, who had received knives, neglected to work, which enraged the Indians in Backhouse's service, and a quarrel ensued, ending in the massacre of Backhouse and all his party. Those who were out collecting bark, on discovering what had happened, fled to Colonel Bologenesi; but in their retreat, while fording a river, the Chunchos poured in a volley of arrows amongst them, and killed forty of their number. Bologenesi then collected a military force and advanced into the forests, where he suffered great hardships, fighting with the Chunchos all day, and harassed by alarms during the night. He, however, collected a thousand quintals of bark, at a cost of fifty lives and three hundred thousand dollars. During this expedition indications were met with of the ancient gold-washings.

It will thus be seen that fevers and perilous roads are not the only dangers to be apprehended in a search for chinchona-plants.

Lastly, and extending for a distance of one hundred and eighty miles, from Marcapata to the frontier of Bolivia, is the watershed along that part of the eastern Andes known as the Snowy Range of Caravaya, where the numerous streams take their rise which unite to form the Ynambari. The Madre de Dios, Marcapata, and Ynambari are thus the three great sources of the Purus. The tributaries of the latter drain the province of Caravaya.

The first mention of this region is to be found in the pages of the old Inca historian, Garcilasso de la Vega, who says that "the richest gold-mines in Peru are those of Collahuaya, which the Spaniards call Caravaya, whence they obtain much very fine gold of twenty-four carats, and they still get some, but not in such abundance."[291] The Jesuit Acosta also mentions "the famous gold of Caravaya in Peru."[292] After the final overthrow of the younger Almagro in the battle of Chupas in 1542, some of his followers crossed the snowy range, and descended into the great tropical forests of Caravaya,[293] where they discovered rivers, the sands of which were full of gold. On the banks of these rivers they built the towns of Sandia, San Gavan, and San Juan del Oro; large sums in gold were sent home to Spain, and the last-named settlement received the title of a royal city from Charles V. In 1553 these settlers received a pardon from the Viceroy Don Antonio de Mendoza, in consideration of the gold they

sent home to the Emperor. It is said that they sent him a nugget weighing four arrobas, in the shape of a bullock's head; and that afterwards another nugget, in the shape of a bullock's tongue, was sent to Philip II., but that the ship which carried it was lost at sea. Eventually the wild Chuncho Indians of the Sirineyri tribe fell upon the gold-washers, and overpowered them. In the following century certain mulattos occupied the gold-washings in Caravaya, and the king, as a reward for their labours in extracting treasure, offered to comply with any request they might make. The mulattos asked to be called Señores, and for the privilege of entering every town on white mules with red trappings, and the bells ringing. The Señores mulattos were finally expelled for knocking the priest of San Juan del Oro on the head while he was saying mass, after a drunken broil. There are many vestiges of washings, bridges, and cuttings made by these mulattos, in different parts of Caravaya.[294]

The Spaniards, however, long continued to extract gold from the rivers of Caravaya, and established coca-farms and coffee-plantations in some of the ravines formed by spurs of the cordillera. Gold, however, was the product for which Caravaya was most famous.

In 1615 the viceroy Marquis of Montes Claros spoke of the rich *lavaderos* or gold-washings of Caravaya;[295] and his successor, the Prince of Esquilache, wrote a long report upon them in 1620. It appears that, at that period, the richest of the Caravaya mines was called Aporuma, and that it had then been worked for fifteen years by a company of adventurers. These men, the chief of whom were named Quiñones, Frisancho, and Perez, had excavated very extensive works to drain off the water, and they petitioned the Viceroy to grant them a *mita* of Indians to complete the works, for that thus the royal fifths would be augmented. The Prince of Esquilache wrote a marginal note, which may still be seen on the original petition, ordering Don Pedro de Mercado, the "visitador-general" of Caravaya, to grant them a *mita* of Indians within a circuit of twenty leagues of the Aporuma mine, with three dollars a month each, besides salt-meat and other provisions.[296] In 1678 the yield of the royal fifths from the Caravaya gold-washings was at the rate of 806 dollars in three months.[297] From this time to the end of the seventeenth century Franciscan missionaries were at work amongst the wild Chunchos in the forests of Caravaya.[298] Towards the end of the last century Caravaya was separated from Peru to form part of the new viceroyalty of Buenos Ayres, and the population of whites and civilised Indians was then only estimated at 6500 souls. Just before that period the town of San Gavan, with four thousand families and a large treasure, had been surprised and entirely destroyed by the Carangas and Suchimanis Chunchos. This calamity took place on the 15th of December, 1767. The viceroy Don Manuel Amat swore vengeance on the Chunchos; but his famous mistress, Mariquita Gallegas, better known as La Perichola, interceded for them, and

eventually nothing was done. The other town of San Juan del Oro had been abandoned some time before; and the very sites where they stood are now uncertain.

In the great rebellion of Tupac Amaru the caciques and people of Caravaya took part with the Indians, probably owing to the influence possessed by the Inca, arising from the large coca estate which belonged to him near San Gavan.[299] At the independence Caravaya became a part of the Peruvian department of Puno.

In 1846 Don Pablo Pimentel was appointed Sub-prefect of Caravaya, and he endeavoured, by giving a glowing account of its vast capabilities, to induce the government to make roads and develop the resources of this important province. Shortly afterwards, in 1849, Caravaya attracted notice as a land rich in the precious metal, and it soon became the California of South America. In July of that year two brothers named Poblete, in searching for chinchona-bark, discovered great abundance of gold-dust in the sands of one of the Caravaya rivers, and the news soon spread far and wide. Up to 1852 crowds of adventurers, among whom were many Frenchmen, continued to follow in the footsteps of the Pobletes, but most of them returned empty, and the excitement has now died away. The trade in chinchona-bark, which once was remunerative, and in which many Peruvians displayed extraordinary energy and endurance of fatigue, ceased to exist in 1847, owing to the habit of adulterating the Calisaya bark with inferior kinds, which gave the Caravaya article a bad name in the market, and at length rendered it unsaleable. This adulteration was practised either through fraud or ignorance. If the former, it was certainly very short-sighted; but Don Pablo Pimentel declares that it was done through ignorance, the bark-collectors mistaking the *motosolo* (C. micrantha) and *carhua-carhua* (Cascarilla Carua) for the Calisaya bark.[300]

The above meagre notices are all that I have been able to glean respecting the history of Caravaya; and I will now give a brief description of the geographical features of this interesting region.

The province of Caravaya consists of a narrow strip of lofty table-land, bordering on that of Azangaro; the snowy range of the Eastern Andes for a distance of 120 miles; and the boundless tropical forests to the eastward, stretching away towards the frontier of Brazil. It is bounded on the east and south by Bolivia, on the N.W. by the province of Quispicanchi in the department of Cuzco, on the north and N.E. by the illimitable forests, and on the west by Azangaro.

The lofty table-land to the westward of the snowy Andes extends for 120 miles, the whole length of Caravaya, but is only from five to ten miles broad. It is 13,000 feet above the level of the sea, and here, about a century ago, after the destruction of San Gavan, the town of Crucero was founded, as a central position for the capital of the province, and as being free from the attacks of wild Indians. It derives its name from the numerous roads which branch from it to the villages on the eastern slopes of the Andes.

This narrow plain, on which Crucero[301] is situated, is very swampy, covered with long tufts of *ychu* grass, and intensely cold. It yields pasture to immense flocks of sheep; and to the curious hybrid, first bred by the cura Cabrera in 1826, between an alpaca and a vicuña, called the paco-vicuña, with a black and white fleece of long fine wool, which is wove into fabrics like the richest silk.[302]

But the largest and only important part of Caravaya consists of the forest-covered valleys to the eastward of the Andes. On the western side that mountain-chain rises abruptly into peaks covered with snow, from an elevated plateau 14,000 feet above the sea; but on its eastern side the descent is rapid into tropical valleys. Long spurs run off the main chain to the northward, gradually decreasing in elevation; and it is sometimes a distance of sixty or eighty miles before they finally subside into the boundless forest-covered plains of the interior of South America. Numerous rivers flow through the valleys between these spurs, to join the Ynambari; and in these valleys, near the foot of the main chain of the eastern Andes, are the few villages and coca and coffee plantations of Caravaya. In these long spurs and deep valleys Caravaya differs in geographical character from the more northern region of Paucartambo, where the Andes subside much more rapidly into the level plain.

In the warm valleys are to be found all the wealth and population of Caravaya. The population consists of 22,000 souls, almost all Indians; and the wealth, besides the flocks of sheep on the western table-land, is created by the produce of coca, coffee, sugar-cane, and aji-pepper plantations, fruit-gardens, and gold-washings. Correct statistical returns are unknown in Peru; but, as near as I could make out, there is an annual yield of 20,000 lbs. of coffee and 360,000 lbs. of coca.[303] I could obtain no reliable statements respecting the yield of gold.

The Caravayan valley which is furthest to the north and west is that of Ollachea, bordering on Marcapata, where there is a small village at the foot of the Andes. Next come those of Ituata and Corani. The little village of Ayapata, near the source of the river of the same name, comes next; and thirty miles further in the interior, an intelligent and enterprising Peruvian, named Don Agustin Aragon, has established a sugar-cane estate called San José de Bella Vista. It is situated at the junction of two rivers, and he is thus protected from the attacks of the savage Chuncho Indians who prowl about in the surrounding forests. He has made a road practicable for mules from the village of Ayapata to his estate; and he finds the manufacture of spirits from the sugar-cane far more profitable than digging for gold or hunting for chinchona-bark. He is a man full of energy and resource. His attempt to establish a manufactory of india-rubber only failed through the refusal of the Peruvian government to give him a contract for supplying the army, and thus assist his first efforts; in 1860 he sent an expedition into the forests to collect wild cacao-plants; any scheme for developing the resources of the country is sure to receive his advocacy; and he looks forward with confidence to the day when a

steamer shall ascend the Purus and Ynambari, and return to the Atlantic with a cargo of the produce of Caravaya. It would be well for Peru if she contained many such men as Don Agustin Aragon.

It is supposed that the old Spanish town of San Gavan was situated near a river of the same name, about twenty miles from Aragon's estate. The site is now overgrown with dense forest, and it has never been visited since its destruction; yet it is believed that vast treasure lies concealed amongst the tree-covered ruins, because the attack of the Chunchos was sudden, and at once successful; they care nothing for the precious metals, and San Gavan contained a royal treasury, and was a central deposit for the gold of Caravaya. The Chunchos, in former times, were in friendly communication with, and even took service under, the Spaniards; but the tyranny of the latter at length exasperated them, and led to the destruction of San Gavan. Since that time the Chunchos have wandered in the forests in small tribes,[304] the implacable enemies of all white men and Inca Indians.

Following the eastern slopes of the Andes to the south-east, the next village to Ayapata, at the head of another deep ravine, is Ccoasa, and next follow Usicayus, Phara, and Limbani. Phara is in a ravine on the eastern slope of the Andes, about thirty-five miles from Crucero. Here many gold-mines were worked by the Señores Mulattos, and at no great distance is the famous gold-mine of Aporuma, in the ravine of Pacchani. Phara is on the road to the gold-diggings, which were discovered by the brothers Poblete, and which attracted so many luckless adventurers between 1849 and 1854. They are at a distance of fifteen leagues to the northward. The path lies along a long ridge, gradually descending for six leagues to a little hamlet called La Mina. Thence to the banks of the river Ynambari, here called Huari-huari, is a distance of three leagues, down a very dangerous road, covered with huge blocks of schist, and skirting along fearful precipices. For this distance the road is passable for mules. The river is seventy yards broad, and is crossed by an *oroya*, or bridge of ropes, traversed by a sort of net or cage, into which the passenger gets, and is hauled over to the other side, at a giddy height above the boiling flood. On the other side, at the junction of the Huari-huari and the golden river of Challuma,[305] there is a place which has been named Versailles by some French adventurers, of whom the most daring and energetic is a M. La Harpe. The road, so far, was opened by a party of soldiers of the batallion Yungay. From Versailles to the *lavaderos* or gold-washings is a distance of six leagues up a narrow forest-covered ravine; and, in this distance, it is necessary to wade across the river Challuma no less than fifty-three times—the water coming up to the waist, the feet constantly slipping over loose rounded stones, the only support a long staff, and where one false step would be inevitable destruction. At the end of this perilous journey there is a place called Alta-garcia, where the *administradores* of the company of first discoverers were established in 1850. Thence to Quimza-mayu (three rivers) is half a league, and here the *lavaderos* commence. In this part of its course the river is called Taccuma. Many of the

gold-seekers, such as the Señores Carpio, La Harpe, Valdez, Tovar, Cardenas, and Costas, have been men who were formerly engaged in the chinchona-bark trade, and who know the country thoroughly. The tributaries of the Challuma, called Quimza-mayu, rise in hills completely isolated from the Andes, and their sands are full of gold, both in dust and nuggets. Immediately above the *lavaderos* rises a hill called Capacurco, and by the French adventurers Montebello, formed of quartz and other primitive rocks, with rich veins of gold. Here Don Manuel Costas of Puno erected a house, and brought out machinery for crushing the quartz, but the undertaking failed through the badness of the machinery, and the immense cost and difficulty of transporting materials through such a country. A few adventurers, however, still continue to wash for gold in the Challuma or Taccuma. In the part of its course above the *lavaderos* this river descends rapidly from an isolated range of forest-covered precipitous hills, and in one place its waters plunge down in a cascade, with a sheer fall of forty feet.[306] The gold-seekers of the Challuma have penetrated further into the forests, and nearer to the main stream of the Purus, than any other explorers; and their discovery of the Challuma, and of the auriferous hills near its banks, has added something to our geographical knowledge of this region.

The remaining villages on the eastern slopes of the Caravayan Andes are Patambuco, Sandia, Cuyo-cuyo, Quiaca, Sina, and the farm of Saqui, on the frontier of Bolivia. The river of Sandia has one of its sources near the pass twenty miles north-east of Crucero, whence it flows past Sandia, and for many leagues down a narrow gorge, with magnificent mountains rising up abruptly on either side. At a distance of twenty miles below Sandia, in a part of the ravine called Ypara, the coca and coffee plantations commence, at a height of 5000 feet above the sea. Beyond Ypara cultivation ceases, and the river, now increased to double its former size by its junction with the Huari-huari, flows for many leagues between mountains covered from their summits with a dense tropical forest. This region is known as San Juan del Oro, once famous for its gold-washings; and here the royal town of the same name stood, founded by the fugitive Almagristas, and afterwards tenanted by the Señores Mulattos, but long since destroyed and abandoned. The forests contain chinchona-trees of valuable species, and, until the last fourteen years, they were frequented by bark-collectors.

While flowing through the forests of San Juan del Oro the river takes a turn to the westward, and, at a distance of sixty miles from Sandia, enters the Hatun-yunca, or Valle Grande, where the people of Sandia have very extensive coca and coffee plantations. The curve here made by the river is so considerable that the people from Sandia reach their farms in the Valle Grande by leaving the ravine above Ypara, and making their way across the grass-covered mountains. The coffee-plants in these farms receive no attention whatever from the time they are planted, so that, instead of the dense well-pruned bushes of India or Ceylon, they grow into tall straggling trees about twelve feet high, with a very small harvest of berries on each, but each berry well exposed to the sun. The coffee is certainly excellent.

Passing through the Valle Grande the river flows on past Versailles, where it receives the golden Challuma, and, uniting with all the other rivers of Caravaya, becomes that great Ynambari which finally effects a junction with the Madre de Dios, and forms the main stream of the mighty Purus.

The river Huari-huari, which is formed by two streams flowing from the villages of Sina and Quiaca, joins the river of Sandia about thirty miles below that town, and their united streams compose the Ynambari. Finally the river Tambopata rises near a farm called Saqui, just within the boundary between Peru and Bolivia, at the foot of a ridge of the Eastern Cordillera. After a course of forty miles it receives the river of San Blas, on the banks of which the people of the Sina village have their coca-plantations. Eighty miles lower down the Tambopata unites with the river Pablo-bamba, on its right bank, at a place called Putina-puncu. The Pablo-bamba rises in a hill called Corpa-ychu on the very frontier of Bolivia, and is only divided from the Tambopata, during its whole course, by a single range of hills. The frontier between the two republics has never been surveyed. Below Putina-puncu the united waters of the two rivers enter the vast forest-covered plains into which the spurs of the Andes finally subside, and henceforth its course is entirely unknown. I think it probable, however, that the Tambopata finds its way direct to the Purus, without previously uniting with the Ynambari.

The respective distances and populations of the villages of Caravaya are as follows:—

	Miles.	Population.
Ollachea to Ituata	12	
,, Corani	10	
,, Ayapata ..	18	
,, Ccoasa	10	12,000
,, Usicayus ..	18	
,, Phara	20	
,, Limbani ..	8	
,, Patambuco ..	16	1,000
,, Sandia	12	4,000
,, Cuyo-cuyo ..	15	2,000
,, Quiaca	21	600
,, Sina	20	600
,, Bolivian frontier	12	
	192	20,200
Macusani to Crucero ..	30	1,800
Population of Caravaya		22,000

But some of these villages are at greater distances from the foot of the Andes than others; thus they are not in a straight line, and the direct distance from Ollachea to the Bolivian frontier is a good deal under 180 miles. The valleys in which the Caravaya villages are situated are separated from each other by spurs of the Andes, many of them so wild and precipitous as to be quite inaccessible; and there is no means of passing from village to village, in many instances, without crossing the Andes to Crucero or

Macusani, and descending again by another pass. For this reason Crucero, being in the most central position, has been chosen as the site of the capital of the province, though in a bleak and intensely cold region.

The geological formation of Caravaya is composed of non-fossiliferous schists, micaceous and slightly ferruginous, with veins of quartz. It is a portion of the extensive system of rocks which Mr. Forbes has grouped together as belonging to the Silurian epoch, and which extends almost continuously over an extent from north-west to south-east of more than seven hundred miles, forming the mountain-chain of the Eastern Andes, continuous from Cuzco, through Caravaya, to Bolivia. These rocks throw off spurs along the eastern side of the main chain. Of this formation, too, are the loftiest mountain-peaks in South America:—Illampu, or Sorata (24,812 feet), and Illimani (24,155 feet). Illampu, Mr. Forbes assures us, is fossiliferous up to its very summit.[307]

Such is a brief account of the geography of Caravaya, and especially of the streams which combine to form the great river Purus, from the rivers of the Paucartambo valley on the extreme north-west, to the Pablo-bamba on the frontier of Bolivia. The streams flowing from the Eastern Andes to the north-west of the Paucartambo system combine to swell the Ucayali, while those to the south-east of the Pablo-bamba fall into the Beni, one of the chief tributaries of the Madeira. The intermediate streams are the sources of the unknown Purus, they are all more or less auriferous, they flow through forests abounding in valuable products, and through countries of inexhaustible capabilities. Yet the courses of very few of them have been explored to distances of seventy miles from their sources, and the main stream of the Purus, one of the principal affluents of the Amazon, may be said to be entirely unknown to geographers.

CHAPTER XIII.

CARAVAYA.—THE VALLEY OF SANDIA.

On the 18th of April I left Crucero, on my way to the chinchona forests, rather late in the afternoon, accompanied by Mr. Weir the gardener, a young mestizo named Pablo Sevallos, and two cargo-mules. After a ride of three leagues along the bleak plain of Crucero, covered with coarse *Stipa* and stunted *Cacti*, we reached a little shepherd's hut, called Choclari-piña, at dusk. It was built of loose stones, with a sheepskin hung across the doorway, but with no plaster or mud between the interstices of the stones, so that the piercingly cold wind blew right through the hut.[308] The poor Indian family were kind and hospitable, and gave us plenty of fresh milk. Next morning we continued the journey along the same plain, with the snowy peaks of the Caravayan Andes on the left, and the glorious nevada of Ananea ahead, whence rise the rivers of Azangaro flowing into lake Titicaca, and of Ynambari finding its way to the Atlantic. A ride of twelve miles brought us to a hut called Acco-kunka (neck of sand), at the foot of long ridges of dark-coloured cliffs, with huge boulders of rock scattered over the sides of the hills. A hard white frost covered the ground.

At Acco-kunka I met a red-faced man, about fifty years of age, who gave his name as Don Manuel Martel. He said that he had been a colonel, and had suffered persecution for being faithful to his party; that he had lost much money in the *cascarilla* trade; and that he was now making a clearing in the forests of Caravaya, for the purpose of growing sugar-cane. He talked about M. Hasskarl, the Dutch agent, who was employed to obtain chinchona-plants in 1854, under his assumed name of Müller; said that he employed an agent named Clemente Henriquez to collect the plants; and vowed that if he, or any one else, ever again attempted to take *cascarilla* (chinchona) plants out of the country, he would stir up the people to seize them and cut their feet off. There was evidently some allusion to myself in his bluster; and I suspected, what afterwards proved to be the case, that Martel had, by some means, got information respecting the objects of my journey, and was desirous of thwarting them. I had always carefully avoided any mention of the subject since leaving Arequipa. Martel said he was going to buy gold-dust at Poti, so I soon got rid of him; and, passing an alpine lake, full of water-fowl, we began the descent into the golden valleys of Caravaya.

On the left a black cliff, perpendicular, and fully 2000 feet high, formed one side of the descent, and the space on its inner side was occupied by a small glacier, the only one I have ever seen in the Andes; whence descends, in a long waterfall, the source of the little river Huaccuyo, which dashes down the ravine. For the first thousand feet the vegetation continues to be of a lowly alpine character, consisting of coarse grass and

flowering herbs, chiefly *Compositæ*, of which there were several *Senecios*, generally with yellow flowers, a gentian with violet-coloured flowers, a *Bartsia* with a yellow flower, a little *Plantago*, and a *Ranunculus*. As we continued the descent, the scenery increased in magnificence. The polished surfaces of the perpendicular cliffs glittered here and there with foaming torrents, some like thin lines of thread, others broader and breaking over rocks, others seeming to burst out of the fleecy clouds; while jagged black peaks, glittering with streaks of snow, pierced the mist which concealed their bases. After descending for some leagues through this glorious scenery, the path at length crossed a ridge, and brought us to the crest of the deep and narrow ravine of Cuyo-cuyo.

The path down the side of the gorge is very precipitous, through a succession of *andeneria*, or terraced gardens, some abandoned, and others planted with ocas (*Oxalis tuberosa*), barley, and potatoes; the upper tiers from six to eight feet wide, but gradually becoming broader. Their walled sides are thickly clothed with Calceolarias, Celsias, Begonias, a large purple Solanum, and a profusion of ferns. But it was not until reaching the little village in the bottom of the hollow that all the glories of the scene burst upon me. The river of Sandia, which takes its rise at the head of the ravine, flows by the village of Cuyo-cuyo, bordered by ferns and wild flowers. It is faced, near the village, with fern-covered masonry, and is crossed by several stone bridges of a single arch. Almost immediately on either side, the steep precipitous mountains, lined, at least a hundred deep, with well-constructed *andeneria*, and faced with stone, rise up abruptly. In several places a cluster of cottages, built on one of the terraces, seemed almost to be hanging in the air. Above all the dark rocks shoot up into snowy peaks, which stood out against the blue sky. A most lovely scene, but very sad, for the great majority of those carefully-constructed terraces, eternal monuments of the beneficence of the Incas, are now abandoned. The alcalde of Cuyo-cuyo received me most hospitably. In the early morning numbers of lambs and young llamas were playing about in the abandoned terraced gardens near the village. Besides Cuyo-cuyo, there are two small hamlets, called Muchucachi and Sullanqui, and several scattered huts in the ravine, the population of which is estimated at 2000 souls.

In the morning of April 20th I rode down the beautiful gorge to the confluence of the rivers of Sandia and Huaccuyo. After this junction the stream becomes a roaring torrent, dashing over huge rocks, and descending rapidly down the ravine towards Sandia. On both sides vast masses of dark frowning mountains rear themselves up for thousands of feet, and end in fantastically shaped peaks, some of them veiled by thin fleecy clouds. The vegetation rapidly increased in luxuriance with the descent. At first there were low shrubs, such as *Baccharis odorata*, *Weinmannia fagaroides*, &c.; which gradually gave place to trees and large bushes; while all the way from Cuyo-cuyo there were masses of ferns of many kinds, Begonias, Calceolarias, Lupins, Salvias, and Celsias. Waterfalls streamed down the mountains in every direction: some in a white sheet of continuous

foam for hundreds of feet, finally seeming to plunge into huge beds of ferns and flowers; some like driven spray; and in one place a fall of water could be seen between two peaks, which seemed to fall into the clouds below.

A most glorious and enchanting scene, allowing little time to think of the road, which was very bad, and in many places most perilous. In its best parts it was like a steep back-attic staircase after an earthquake. Three leagues from Cuyo-cuyo is the confluence of the torrent of Ñacorequi with the river of Sandia; and after this point maize begins to be cultivated, where the craggy jutting cliffs permit, between the river and the mountains. The Indians live in eyrie-like huts, perched at great heights, here and there, amongst the maize terraces. The village of Sandia is at a distance of fifteen miles from Cuyo-cuyo, down this ravine, a dilapidated little place, with more than half the houses roofless and in ruins. It is built along the banks of the river, and has a church in the *plaza*. The mountains rise up all round it, almost perpendicularly, forming a close amphitheatre; and in two places glittering cascades foam down from their very summits, into the bushes on a level with the town.

The descent from the summit of the pass over the Caravayan Andes to Sandia is very considerable, nearly 7000 feet in thirty miles, from an arctic to a sub-tropical climate. The height of Crucero is 12,980 feet; of the pass 13,600; of Cuyo-cuyo 10,510; and of Sandia 6930 feet above the sea.[309]

The four mountains closely hemming in the village of Sandia are mount Chicanaco, which is beautified by a splendid cascade; mount Vianaco, which ends in two fine wooded peaks, between which a long slender thread of water descends into the foliage midway; mount Camparacani, on the other side of the river, which rises up to a stupendous height, ending in a jagged rocky peak; and mount Catasuyu, which completes the circle, rising abruptly above the church. The name of Sandia is probably a corruption of the Spanish word *sandilla*, the first settlers having mistaken the quantities of gourds which grow here for *sandillas* or water-melons.

When I arrived in Sandia the governor was absent on his estate; the cura, my good friend Dr. Guaycochea, was getting in his maize-harvest on his land near Cuzco; and the principal remaining inhabitants were the Juez de Paz, Don Francisco Farfan, and one Don Manuel Mena, who was drunk in bed when I arrived, but who afterwards received me very hospitably. These good people are, in manners and education, the roughest backwoodsmen, much too fond of aguardiente, and addicted to chewing coca to excess; but they are warm-hearted and neighbourly, while they display some energy in working the coffee and coca estates in the distant montaña, and in making roads, such as they are, from these estates to Sandia. The richer people of Sandia all have more or less of Indian blood, and their wives and daughters are unable to speak any language but Quichua; and thus they seem to be more closely united in interests and feelings with the mass of the population than in any other part of Peru. The Indians of the district of

Sandia are divided into six *ayllus* or tribes, besides the inhabitants of the villages of Sandia, Cuyo-cuyo, and Patambuco. These *ayllus* are established on the mountains around Sandia, living in scattered huts, some cultivating maize and potatoes, others raising barley and alfalfa for mules. The *ayllus* are called Laqueque, about a league up the river, on the right bank; Cuyo-cuyo (not the village), behind mount Camparacani; Oruro, on the heights below Cuyo-cuyo; Quiaca (not the village), near Oruro; Quenequi, about a league down the river; and Apabuco, behind mount Catasuyu. The population of the parish of Sandia is about 7000; 4000 in Sandia and its six *ayllus*, 2000 in the village and ravine of Cuyo-cuyo, and 1000 in Patambuco. As many as 1000 souls fell victims to the dreadful pestilence of 1855, which raged over all parts of the Andes of Peru. Nearly every Indian family, besides land near Sandia, owns a small farm of coca or coffee down in the montaña, to which men, women, and children go at harvest-time. As in all parts of the Andes, so in the Sandia ravine, I constantly found the Indians civil, obliging, and respectful, always saluting with an "Ave Maria Taytay!" and a touch of the hat in passing. They are reserved and silent, it is true, and superficial observers take this for stupidity. Never was there a greater mistake: their skill in carving and all carpenter's work, in painting and embroidery, the exquisite fabrics they weave from vicuña-wool, the really touching poetry of their love-songs and *yaravis*, the traditional histories of their *ayllus*, which they preserve with religious care, surely disprove so false a charge.

The houses in Sandia are the merest barns, with mud-walls, and roofs which let the water in. All the family sleep together in a promiscuous way; pigs and fowls wandering over the floor at early dawn. The Juez de Paz, Francisco Farfan, administers justice in such a place as this, lounging on a sort of mud-platform at one end of the room, where his bed is made up, while the culprit, and a crowd of alcaldes and spectators, stand before him. Every one chatters at the same time for about ten minutes, and the prisoner is sent to the lock-up. The Jueces de Paz have to render periodical accounts of all their cases, attested by witnesses, to the Juez de Primera Instancia in the capital of the province.

While upon the subject of these local authorities, it will be well to give an account of the powers placed in their hands by the Constitution of 1856, by which Peru is now governed; both because the measures then adopted will, I believe, have a lasting and beneficial effect on the people, and because the persons so vested with power endeavoured to display their patriotic zeal by throwing obstacles in my way. By this constitution it was provided that in the capital of each department there should be a *Junta Departmental*,[310] the members of which should be elected in the same way and with the same qualifications as those for the National Congress, to meet every year. These *Juntas* were to deliberate and legislate for the advancement and material progress of the departments, their decrees being null if contrary to any law of Congress. The evident objection to this measure is its tendency to split the country up into small communities with separate interests, which has always proved to be most disastrous in

thinly-peopled and half-civilized states. This view is taken in a very able article on the constitution, in a periodical published at Lima, where the *Juntas Departmentales* are declared to be the initiation of a system of "federation," the result of which has always been to dismember countries into so many small depopulated districts, as in Mexico, Central America, New Granada, and the Argentine Republic, introducing civil war, anarchy, and dissolution. The writer might now add the dis-United States of North America also.[311]

But the institutions to which I before alluded, as having had a beneficial effect, are the *Juntas Municipales*,[312] which were to be established in every district where materials existed to form them, and to have the regulation of the local funds and improvements. They were to consist of the most influential citizens, elected by their fellow townsmen, and were to attend to local interests, have charge of the civic registers, take the census, &c. The same writer speaks of these municipalities in terms of unqualified praise, and says that their establishment is a positive good, without in any way promoting a federation which would be ruinous to Peruvian nationality.[313] They will give young men the opportunity of becoming acquainted with public affairs, teach them habits of business, and gradually train them for more important political duties. I look upon these institutions as one of the sources of hope for a brighter future for Peru; and as long as they show activity, whether in a right or wrong direction, they must be productive of good. The habit of taking an active part in public affairs must be better than the torpor and indifference which formerly prevailed. I saw several signs of activity in these *Juntas Municipales* during my journey from Puno. At Lampa they were actively engaged in an endeavour to re-establish a manufactory of glazed tiles in that town; in Azangaro they were collecting subscriptions for a bridge across the river, to which one of their body had contributed half the required sum; and in Sandia they were drawing up a report on the state of the roads, with an estimate of the sum required for their thorough repair and bridging. I was happy to be able to assist the Sandia Municipality, by preparing a map for them, to illustrate their report. The *Juntas Municipales* of Sandia and Quiaca also, especially the latter, took measures to prevent me from procuring a supply of chinchona-plants or seeds, influenced by motives which exposed their ignorance of political economy, while it displayed their activity and patriotic zeal.

In Sandia the municipal body consists of the Alcalde Municipal, who presides, the Teniente Alcalde, the Syndic, two Judges of the Peace, three Regidores, one of whom is Don Manuel Mena, and a Secretary.

My original plan had been to examine the chinchona forests during this month, make as many meteorological and other observations as was possible, and perhaps send down a small collection of plants to the coast; but to make the principal collection of plants and seeds in August, the month when the seeds of *C. Calisaya* are ripe. I had not, however, been two days in Sandia before I discovered that Martel had already written to several

of the inhabitants, urging them to prevent me from taking chinchona plants or seeds out of the country, and to bring the matter before the *Junta Municipal* of the district. I heard also that he was busying himself in the same way in other villages bordering on the chinchona forests. My mission was becoming the talk of the whole country; and I at once saw that my only chance of success was to commence the work of collecting plants without a moment's delay, and, if possible, anticipate any measures which might be taken to thwart my designs.

It was at Sandia that it became necessary to make final preparations for a journey into the forests, for beyond this point the possibility of procuring supplies of any kind is very doubtful. I here laid in a stock of bread to last for about a month, which was toasted in the oven belonging to the cura, the only one in the place, and which, together with some chocolate and cheese, formed the provisions for myself and the gardener. I then persuaded the judge to order the alcaldes of four of the *ayllus* to procure four Indians and two cargo-mules, the Indians to bring their own provisions with them, for which I advanced them money. After considerable delays my little expedition was ready to start, consisting of myself, Mr. Weir the gardener, Pablo Sevallos the mestizo, four Indians, and two mules. The supplies and provisions were packed in six leathern bags, containing tea and sugar, chocolate, toasted bread, cheese, candles, concentrated beef-tea, changes of clothes, instruments, powder and shot, besides a tent, an air-bed, gutta-percha robes, ponchos, a wood-knife and trowel, and maize and salt meat for Pablo and the Indians. It took several days to complete these preparations.

The climate of Sandia, at this time of the year, is exceedingly agreeable, the days being fine and clear until late in the afternoon, and not too hot. The prevailing wind blows up the ravine from the north-east, being the trade which comes across the vast forest-covered plains of the interior. It is this warm trade-wind which produces a much milder climate and more tropical vegetation in Cuyo-cuyo than in Arequipa, though the former place is three thousand feet higher than the latter. In Sandia, just after sunset, it feels rather chilly, and during the middle of the day the sun is exceedingly hot. Light clouds generally hang about the highest peaks. The variety of most beautiful and graceful ferns on the walls of the houses, and near the banks of the river, is endless.

I had the satisfaction of seeing, in the house of Don Manuel Mena, before leaving Sandia, a bundle of small branches of the *ychu cascarilla* (*C. Calisaya, var. β Josephiana*), with leaves and flowers, which had been collected as a tonic medicine for a little daughter of my host.

On the 24th of April, late in the afternoon, we left Sandia, and reached the *tambo*, or travellers' hut, called Cahuan-chaca, before dark. The road leads down the ravine, along narrow ledges overhanging the river, which dashes furiously along, in most places between perpendicular cliffs. The path is very narrow and dangerous, but the scenery is

superb, and the vegetation becomes richer and more tropical at every league of the descent.

One of the Indians traitorously fled on the first day, and my party was thus reduced to three, who were barely able to carry the necessary provisions. These three men proved faithful and willing fellow-labourers. Their names were Andres Vilca of the Oruro *Ayllu*, Julian Ccuri of Cuyo-cuyo, and Santos Quispi of Apabuco. They were fine-looking young fellows, wearing their hair in long plaits down their backs, coarse canvas trousers and shirts. They carry the cargos in large cloths tied in bundles, and placed in other cloths, which are passed over one shoulder and tied across the chest, called *ccepis*. They stoop forward and step out at a great rate; and it is in this way that Indians carry their burdens along the roads, and women their children, throughout Peru. The *tambo* of Cahuan-chaca is a shed, with one side open, and we slept in company with three Indians and a woman on their way to get in a coca-harvest in the Hatun-yunca, who were living very well on salt mutton, eggs, and potatoes.

The river rushing down the valley winds along the small breadth of level land, striking first against the precipitous cliffs on one side, and then sweeping over to the other, so that a road in the bottom of the valley would require a bridge at almost every hundred yards. It has, therefore, been necessary to excavate a path in the sides of the mountains, high above the river, which in some places has a breadth of three feet only, with a perpendicular cliff on one side, and a precipice six or seven hundred feet deep on the other; while, in others, it zigzags down amongst loose stones, where one false step would be immediate destruction. But the scenery continued to increase in beauty, and the cascades were really splendid:—

"A land of streams! some, like a downward smoke,
Slow-dropping veils of thinnest lawn, did go;
And some thro' wavering lights and shadows broke,
Rolling a slumbrous sheet of foam below."

The river dashed noisily through the centre of the gorge, and the masses of green on either side were toned down by many flowers in large patches, bright purple *Lasiandræ*, orange *Cassiæ*, and scarlet *Salviæ*. I also saw an *Indigofera* growing in this part of the ravine.

A mile from the hut of Cahuan-chaca is the confluence of the river Huascaray; and a league lower down is the little shed or tambo of Cancallani. Here bamboos and tree-ferns first appear, and coca is cultivated in terraces which are fringed with coffee-plants, with their rich green foliage and crimson berries. I observed that the huts in the middle of these patches of coca or maize had no doors, showing the confidence of the inmates in the honesty of the numerous passers-by, who go to and fro between Sandia

and the more distant coca estates.[314] I passed the estate of Chayllabamba, with terraces of coca at least fifty deep, up the sides of the mountains; and Asalay, a coffee estate, with groves of orange and chirimoya-trees, the extreme point reached by M. Hasskarl, the Dutch collector, in 1854. At the confluence of the rivers Asalay and Sandia perpendicular cliffs rise abruptly from the valley to a stupendous height on both sides, and the path winds up in a serpentine slippery staircase, to creep along the edge of the steep grassy slopes or *pajonales*, far above the tropical vegetation of the ravine. Winding along this path, we came to the *tambo* of Paccay-samana, on the grassy *pajonal*, the mountains rising up on the opposite side of the ravine only about sixty yards distant; yet the river, in the bottom of the gorge, was many hundreds of feet below. There were thickets with masses of bright flowers in the gullies, and glorious cascades shimmering in the sunlight on the opposite mountain-sides.

It was at this spot that we first encountered chinchona-plants. A number of young plants of *C. Calisaya*, *var. β Josephiana*, were growing by the side of the road, with their exquisite roseate flowers, and rich green leaves with crimson veins. The rock is a metamorphic slate, unfossiliferous, slightly micaceous, and ferruginous, with quartz occurring here and there: the soil a stiff brown loam. Above the tambo there was a small thicket of gaultherias, called *ccarani* in Quichua, and Melastomaceæ with bright purple flowers (*Lasiandra fontanesiana*), in a shallow gully, surrounded by the rich broad-bladed grass of the *pajonal*. Here there were some fine plants of the chinchona named by Dr. Weddell *C. Caravayensis*; and further on more plants of *C. Josephiana*, called *ychu cascarilla* by the natives. The height of this spot is 5420 feet above the sea. A tree-fern and many *Trichomanes* were growing with the chinchonæ. Paccay-samana is sixteen miles from Sandia.

Animal life did not appear to be very abundant. There were plenty of large doves, some ducks near the river, and a brilliant woodpecker. I also saw great numbers of large swallow-tailed butterflies, purple with light-blue spots on the upper wings; and others with white upper wings edged with jet black and rows of white spots, the lower wings orange.

Beyond Paccay-samana there were several more plants of *C. Josephiana*, rising out of masses of maiden-hair and *Polypodia*. After following the edge of the pajonal for about a mile, we descended by a precipitous zigzag path and crossed over the river Pulluma, at its confluence with the Sandia. Here the road to the Hatun-yunca or Valle Grande branches off up the mountain of Ramas-pata, while our way continued down the ravine. The scenery is here remarkably beautiful. Lofty mountains, with their bright cascades, are clothed to their summits with rich grass, while their gullies are filled with flowering trees and shrubs. Half-way up, in many directions, the stone terraces of coca rise tier above tier, fringed with ferns and begonias, and filled with the delicate coloured green coca-branches, diversified occasionally by the darker hues of the coffee. The ravine is

filled with masses of purple Melastomaceæ, and the river is fringed with tree-ferns, plantains, and bamboos.

This purple Melastomacea (*Lasiandra fontanesiana*), called in Quichua *panti-panti*, in the brilliancy and abundance of its flowers, bears the same relation to this part of the Peruvian Andes as the rhododendron does to the Himalayas. The effect in masses is much the same, but the *Lasiandra* appears to me to be a more graceful and delicate tree, with a more beautiful flower. In this ravine we have the shrub chinchonæ on the high grassy slopes, perhaps the finest coffee in the world near the banks of the river, and a little galium by the road-side—all chinchonaceous plants.

At noon on April 26th we rested in the tambo of Ypara, in the centre of coca cultivation, and in the afternoon, crossing the river by a wooden bridge, we had to travel along the skirts of the mountains, at a considerable height, in the region of the *pajonales*. No gullies or large cascades cut up the face of these mountains, which were entirely exposed to the full glare of the sun, and here, though there was a profusion of purple Melastomaceæ in some of the shallow indentations, there were no chinchonæ. Towards evening we came to a lofty spur of the mountain, called Estanqui, at a great height above the ravine, whence there was a most extensive view. To the left was the valley of Sandia, with little coca-farms nestling in all the sheltered gullies; and I could just make out the boys and girls far far below, like specks, busy with the coca-leaves in the drying-yards. In front there was a distant view of the hills in the direction of San Juan del Oro, covered with virgin forest; while at our feet, and a thousand feet below us, was the confluence of the rivers Sandia, Llaypuni, and Huari-huari, which unite to form the great river Ynambari.

It was my intention, after marking down all the eligible plants of the shrubby *Calisaya*, to be taken up on our return, to make for the forest-covered valley of Tambopata, which is full of chinchona-trees; and I therefore left the ravine of the Sandia river at this point, and, by a rapid descent, went down from the grassy uplands to a region of tropical forest, full of palms and tree-ferns. We thus reached the banks of the Huari-huari. This river flows through a deep and very narrow ravine, lined with forest, for about 500 feet, above which rise grassy mountains to an immense height. Though only 30 feet across, and confined by dark polished rocks, the Huari-huari is very deep, and decidedly a more important stream than the Sandia, at their junction.

We established ourselves under a rock, where there was no room to pitch the tent, and thus our first night of camping out commenced, for previously we had slept in the road-side *tambos*. The Indians carried little earthen pots for cooking, in their *ccepis*, and got up a fire of dry sticks with great rapidity. I had a delicious bath in the river, where the tall forest trees overshadowed the water on either side. At night the moon streamed its floods of light over the forest, and the brilliant sparks from myriads of fire-flies shone from the trees in every direction up the side of the opposite mountain; but in the early

morning the sky clouded over, and a heavy drizzling rain began to fall, which prevented sleep, and made us wish for day.

From this encampment our way led up the precipitous sides of the mountain, to the grassy *pajonales* which divide the valleys of Sandia and Tambopata; but I will here halt awhile to give a brief account of the cultivation of that plant, of which we had lately seen so much, and which enabled me to ascend the mighty passes of the Andes on foot with ease and comfort—the strength-giving, invigorating coca.

A general geographical description of all this country has been given in the preceding chapter.

During my stay at Sandia the indications of the thermometer were as follows, between the 20th and 25th of April:—

Mean temperature	63⅕°
Minimum temperature at night	50½
Highest observed	65
Lowest	47
Range	18

CHAPTER XIV.

COCA-CULTIVATION.

THE coca-leaf is the great source of comfort and enjoyment to the Peruvian Indian; it is to him what betel is to the Hindoo, kava to the South Sea Islander, and tobacco to the rest of mankind; but its use produces invigorating effects which are not possessed by the other stimulants. From the most ancient times the Peruvians have used this beloved leaf, and they still look upon it with feelings of superstitious veneration. In the time of the Incas it was sacrificed to the Sun, the Huillac Umu or high priest chewing the leaf during the ceremony; and, before the arrival of the Spaniards, it was used, as the cacao in Mexico, instead of money. After the conquest, although its virtues were extolled by the Inca Garcilasso de la Vega,[315] and by the Jesuit Acosta,[316] some fanatics proposed to proscribe its use, and to root up the plants, because they had been used in the ancient superstitions, and because its cultivation took away the Indians from other work. The second council of Lima, consisting of bishops from all parts of South America, condemned the use of coca in 1569 because it was a "useless and pernicious leaf, and on account of the belief stated to be entertained by the Indians that the habit of chewing coca gave them strength, which is an illusion of the devil."[317]

In speaking of the strength the coca gives to those who chew it, Garcilasso do la Vega relates the following anecdote. "I remember a story which I heard in my native land of Peru, of a gentleman of rank and honour, named Rodrigo Pantoja, who, travelling from Cuzco to Rimac (Lima), met a poor Spaniard (for there are poor people there as well as here) who was going on foot, with a little girl aged two years on his back. The man was known to Pantoja, and they thus conversed. 'Why do you go laden thus?' said the knight. The poor man answered that he was unable to hire an Indian to carry the child, and for that reason he carried it himself. While he spoke Pantoja looked in his mouth, and saw that it was full of coca; and, as the Spaniards abominate all that the Indians eat and drink, as though it savoured of idolatry, particularly the chewing of coca, which seems to them a low and vile habit, he said, 'It may be as you say, but why do you eat coca like an Indian, a thing so hateful to Spaniards?' The man answered, 'In truth, my lord, I detest it as much as any one, but necessity obliges me to imitate the Indians, and keep coca in my mouth; for I would have you to know that, if I did not do so, I could not carry this burden; while the coca gives me sufficient strength to endure the fatigue.' Pantoja was astonished to hear this, and told the story wherever he went; and from that time credit was giving to the Indians for using coca from necessity, and not from vicious gluttony."

The Spanish Government interfered with the cultivation from more worthy motives, and *mitas* of Indians, for the purpose of collecting coca-leaves, were forbidden in 1569, owing to the reputed unhealthiness of the valleys.[318] Finally Don Francisco Toledo, viceroy of Peru, permitted the cultivation with voluntary labour, on condition that the Indians were well paid, and that care was taken of their healths. This most prolific of Peruvian legislators issued no less than seventy *ordenanzas* on this subject alone, between the years 1570 and 1574. Coca has always been one of the most valuable articles of commerce in Peru, and it is used by about 8,000,000 of the human race.

The coca-plant (*Erythoxylon coca*)[319] is cultivated between 5000 and 6000 feet above the level of the sea, in the warm valleys of the eastern slopes of the Andes, where almost the only variation of climate is from wet to dry, where frost is unknown, and where it rains more or less every month in the year. It is a shrub from four to six feet high, with lichens, called *lacco* in Quichua, usually growing on the older trunks. The branches are straight and alternate; leaves alternate and entire, in form and size like tea-leaves; flowers solitary with a small yellowish-white corolla in five petals, ten filaments the length of the corolla, anthers heart-shaped, and three pistils.

Sowing is commenced in December and January, when the rains begin, which continue until April. The seeds are spread on the surface of the soil in a small nursery or raising-ground called *almaciga*, over which there is generally a thatch roof (*huasichi*). At the end of about a fortnight they come up; the young plants being continually watered, and protected from the sun by the *huasichi*. The following year they are transplanted to a soil specially prepared by thorough weeding, and breaking up the clods very fine by hand; often in terraces only affording room for a single row of plants, up the sides of the mountains, which are kept up by small stone walls. The plants are generally placed in square holes called *aspi*, a foot deep, with stones on the sides to prevent the earth from falling in. Three or four are planted in each hole, and grow up together. In Caravaya and Bolivia the soil in which the coca grows is composed of a blackish clay, formed from the decomposition of the schists, which form the principal geological features of the mountains. On level ground the plants are placed in furrows called *uachos*, separated by little walls of earth *umachas*, at the foot of each of which a row of plants is placed; but this is a modern innovation, the terrace cultivation being the most ancient. At the end of eighteen months the plants yield their first harvest, and continue to yield for upwards of forty years. The first harvest is called *quita calzon*, and the leaves are then picked very carefully, one by one, to avoid disturbing the roots of the young tender plants. The following harvests are called *mitta* ("time" or "season"), and take place three times and even four times in the year. The most abundant harvest takes place in March, immediately after the rains; the worst at the end of June, called the *mitta de San Juan*. The third, called *mitta de Santos*, is in October or November. With plenty of watering, forty days suffice to cover the plants with leaves afresh. It is necessary to weed the

ground very carefully, especially while the plants are young, and the harvest is gathered by women and children.

The green leaves, called *matu*, are deposited in a piece of cloth which each picker carries, and are then spread out in the drying-yard, called *matu-cancha*, and carefully dried in the sun. The dried leaf is called *coca*. The drying-yard is formed of slate-flags, called *pizarra*; and, when the leaves are thoroughly dry, they are sewn up in *cestos* or sacks made of banana-leaves, of twenty pounds each, strengthened by an exterior covering of *bayeta* or cloth.[320] They are also packed in *tambores* of fifty pounds each, pressed tightly down. Dr. Poeppig reckoned the profits of a coca-farm to be forty-five per cent.

The harvest is greatest in a hot moist situation; but the leaf generally considered the best flavoured by consumers, grows in drier parts, on the sides of hills. The greatest care is required in the drying; for too much sun causes the leaves to dry up and lose their flavour, while, if packed up moist, they become fetid. They are generally exposed to the sun in thin layers.

Acosta says that in his time the trade in coca at Potosi was worth 500,000 dollars annually; and that in 1583 the Indians consumed 100,000 *cestos* of coca, worth 2½ dollars each in Cuzco, and 4 dollars in Potosi. In 1591[321] an excise of 5 per cent. was imposed on coca; and in the years 1746 and 1750 this duty yielded 800 and 500 dollars respectively, from Caravaya alone. Between 1785 and 1795 the coca traffic was calculated at 1,207,430 dollars in the Peruvian viceroyalty; and, including that of Buenos Ayres, 2,641,487 dollars.

In the district of Sandia, in Caravaya, there are two kinds of coca, that of Ypara and that of Hatun-yunca, which has a larger leaf. The yield is 45,000 cestos a year. In the yungus of La Paz, in Bolivia, the yield is about 400,000 cestos. The coca-trade is a government monopoly in Bolivia, the state reserving the right of purchasing from the grower, and reselling to the consumer. This right is generally farmed out to the highest bidder. In 1850 the coca-duty yielded 200,000 dollars to the Bolivian revenue.

The approximate annual produce of coca in Peru is about 15,000,000 lbs.,[322] the average yield being about 800 lbs. an acre. More than 10,000,000 lbs. are produced annually in Bolivia, according to Dr. Booth of La Paz; so that the annual yield of coca throughout South America, including Peru, Bolivia, Ecuador, and Pasto, may be estimated at more than 30,000,000 lbs. At Tacna the *tambor* of 50 lbs. is worth 9 to 12 dollars, the fluctuations in price being caused by the perishable nature of the article, which cannot be kept in stock for any length of time. The average duration of coca in a sound state, on the coast, is about five months, after which time it is said to lose flavour, and is rejected by the Indians as worthless.

The reliance on the extraordinary virtues of the coca-leaf, amongst the Peruvian Indians, is so strong, that, in the Huanuco province, they believe that, if a dying man can taste a leaf placed on his tongue, it is a sure sign of his future happiness.[323]

No Indian is without his *chuspa* or coca-bag, made of llama-cloth, dyed red and blue in patterns, with woollen tassels hanging from it. He carries it over one shoulder, suspended at his side; and, in taking coca, he sits down, puts his *chuspa* before him, and places the leaves in his mouth one by one, chewing and turning them till he forms a ball. He then applies a small quantity of carbonate of potash, prepared by burning the stalk of the quinoa-plant, and mixing the ashes with lime and water; thus forming cakes called *llipta*, which are dried for use, and also kept in the *chuspa*.[324] This operation is called *acullicar* in Bolivia and Southern Peru, and *chacchar* in the North. They usually perform it three times in a day's work, and every Indian consumes two or three ounces of coca daily.

In the mines of the cold region of the Andes the Indians derive great enjoyment from the use of coca; the running *chasqui*, or messenger, in his long journeys over the mountains and deserts, and the shepherd watching his flock on the lofty plains, has no other nourishment than is afforded by his *chuspa* of coca, and a little maize. The smell of the leaf is agreeable and aromatic, and when chewed it gives out a grateful fragrance, accompanied by a slight irritation, which excites the saliva. Its properties are to enable a greater amount of fatigue to be borne with less nourishment, and to prevent the occurrence of difficulty of respiration in ascending steep mountain-sides. Tea made from the leaves has much the taste of green tea, and, if taken at night, is much more effectual in keeping people awake. Applied externally coca moderates the rheumatic pains caused by cold, and cures headaches. When used to excess it is, like everything else, prejudicial to the health, yet, of all the narcotics used by man, coca is the least injurious, and the most soothing and invigorating.

The active principle of the coca-leaf has, a few years ago, been separated by Dr. Niemann, and called *cocaine*. Pure *cocaine* crystallizes with difficulty, is but slightly soluble in water, but is easily dissolved in alcohol, and still more easily in ether.[325]

I chewed coca, not constantly, but very frequently, from the day of my departure from Sandia, and, besides the agreeable soothing feeling it produced, I found that I could endure long abstinence from food with less inconvenience than I should otherwise have felt, and it enabled me to ascend precipitous mountain-sides with a feeling of lightness and elasticity, and without losing breath. This latter quality ought to recommend its use to members of the Alpine Club, and to walking tourists in general, though the sea voyage would probably cause the leaves to lose much of their virtue. To the Peruvian Indian, however, who can procure it within a few weeks of its being picked, the coca is a

solace which is easily procured, which affords great enjoyment, and which has a most beneficial effect.[326]

CHAPTER XV.

CARAVAYA.

Chinchona forests of Tambopata.

On the morning of April 27th we crossed a rude bridge over the Huari-huari, and began to make our way up the face of the steep mountain on the other side, first through a thick forest, and then up into the grassy highlands, until, after several halts, we at length reached the summit of the ridge, though a mountain-peak still rose up in our rear. From this point there was a most extensive panoramic view. A sea of ridges rose one behind the other, with stupendous snowy peaks in the background, and, more than a thousand feet below, the rivers of Sandia and Huari-huari, reduced to mere glittering threads, could be seen winding through the tortuous ravines. We had now reached the *pajonales*, and were on a ridge or back-bone between the rivers of Laccani and San Lorenzo, two tributaries of the Huari-huari; a grass-covered and comparatively cold region, interspersed with thickets, forming the crest of the tropical forests which line the sides of the ravines through which the rivers wind, far below.

When there is sunshine, these *pajonales* form a very pleasant landscape: the broad expanse of grass, dotted over with a graceful milk-white flower called *sayri-sayri*, is intersected by dense thickets, some in the gullies and watercourses, and others in clumps, like those in an English park, the palms and tree-ferns raising their graceful heads above the rest of the trees. Here and there a black pool of sweet water is met with at the edge of the thicket, with chinchona and *huaturu*-trees drooping over it. Everywhere there is an abrupt boundary to the foreground in the profound forest-covered ravines, with splendid views of mountain ranges in the distance.

The vegetation of the thickets in these *pajonales* consists of *palms*, *tree-ferns*, *Melastomaceæ* (*Lasiandra fontanesiana*) with bright showy flowers, exceedingly pretty *Ericaceæ* (*Gaultheriæ*), *Vacciniæ*, the *huaturu* or incense-tree in great quantities, and *Chinchonæ*, chiefly consisting of *C. Caravayensis* (Wedd.), with a few plants of *Calisaya Josephiana*, but the latter are much more rare here than in the neighbourhood of Paccay-samana. The *C. Caravayensis*, a worthless species, has panicles of beautiful deep roseate flowers, large coarse hairy capsules, and lanceolate leaves, above smooth with purple veins, and hairy on the under side. It can probably bear greater cold than any other chinchona.[327]

The afternoon was passed in searching for plants of the shrubby *Calisaya*, but with little success. During our examination of the thickets we found a single specimen, evidently belonging to the *Calisaya* species, but in the form of a tree, and not of a shrub. Its height

was eighteen feet six inches; its girth, two feet from the ground, eight and a half inches; and the position in which it was growing was 5680 feet above the level of the sea. I was uncertain whether it belonged to the tree variety (*Calisaya vera*, Wedd.), or to the shrub (*Calisaga Josephiana*); for Dr. Weddell only gives the height of the latter at eight or ten feet.

Near the banks of one of the black pools, overhung by spreading branches, we found a shed, a roof of coarse grass raised on four sticks four and a half feet high, and here we encamped for the night. It had been made by some party of incense-collectors from Bolivia, who wander through these wilds. Towards sunset it began to pour with rain, and continued through the night.

From this point to the Tambopata valley the road was unknown to my Indians, and had not been traversed since the time of the bark-trade, which came to an end fifteen years ago. It was supposed that any path which might once have existed would be entirely choked up by the forest, and I therefore started early in the morning, with Andres Vilca, to reconnoitre. The backbone of the ridge along which we travelled was not level, but up and down like a saw, and very rough work. After walking for a league the ridge ended where a transverse range of hills, at a lower elevation, connects the mountains on the further sides of the rivers of San Lorenzo and Laccani, and, closing up the ravines, contains their sources. This range, at right angles with the one over which we had journeyed, is called the *Marun-kunka*, and is covered with dense forests. It was necessary to force our way through this formidable obstruction, and we plunged into it at once. Our progress was vigorously opposed by closely matted fallen bamboos for the first few hundred yards, and afterwards we followed the course of a torrent, deeply cut in the rock, and forming a passage four to six feet deep, and about three feet across, with masses of ferns and the roots of enormous forest-trees interlacing across overhead, and two feet of exceedingly tenacious yellow mud underfoot. In many places it was almost dark at midday, while in others the rays of the sun succeeded in forcing their way through the ferns, and throwing a pale light across the otherwise gloomy passage. It was a weird unearthly scene. After several hours of very laborious travelling we at length forced our way across the Marun-kunka, and came out upon another *pajonal*, on the eastern side, whence there was a grand view of the forest scenery towards Tambopata, and the snowy peaks of the cordillera above Quiaca and Sina to the right.

The afternoon was again devoted to searching for plants of *Calisaya Josephiana* in the thickets; where the *C. Caravayensis* was very plentiful, together with several plants of the shrubby *Calisaya*, and four or five trees of the normal tree *Calisaya*, from 20 to 30 feet high. The elevation of this place was 5600 feet above the sea. Later in the day the journey was continued over a most difficult country, sometimes over grassy *pajonales*, and at others painfully struggling through forests like those on the Marun-kunka. In one of these forests I came upon a *Calisaya*-tree, 38 feet high, and 1 foot 3 inches in girth at

a distance of 3 feet from the ground, which was several feet deep in dead leaves, chiefly the smooth leathery leaf of the *huaturu*-tree. At length we commenced the descent into the valley of Tambopata, 1200 feet down slippery rocks and grass, then through a belt of forest, until we suddenly emerged on an open space on the banks of the large rapid river, where there was a bamboo hut. A little coca and sugar-cane was planted, but the occupant was absent. With touching confidence he had left his door open, so my Indians established themselves comfortably, while Weir and I pitched the tent.

The river of Tambopata, descending from the farm of Saqui near the frontier of Bolivia, here flows in a northerly direction. Up the stream I could see a few little clearings, but looking down nothing appeared but the virgin forest. A most magnificent range of mountains, with a fine growth of forest trees, rises up on either side, and the rapid swollen river rushed through the centre of the ravine. The rock of all the ranges of hills between the Huari-huari and Tambopata rivers is a yellow clay-slate, with masses of white quartz cropping out on the *pajonales*.

Early in the morning we continued our journey down the valley, through a forest of grand timber, passing the little hut of Tambopata which Dr. Weddell had mentioned to me as having been the great rendezvous for *cascarilleros* or chinchona-bark collectors, at the time of his visit. After wading across the rapid little river of Llami-llami, which enters the Tambopata on the left bank, we came to a small clearing, planted with sugar-cane, the property of a very energetic and obliging old Bolivian, named Don Juan de la Cruz Gironda. He was living in a shed, open on two sides, and with a young son, and two or three Indians, was actively clearing, planting sugar-cane, and making rum in an extemporized distillery of his own manufacture. This little farm was the extreme outpost of civilisation in this direction, and had only been commenced since December 1859.

Gironda was cultivating sugar-cane, maize, and edible roots; and, at the time of my visit, he was just commencing his *michca*, or small sowing of maize. His people were driving holes in the ground with long poles, about a foot deep, into which they drop four to six grains, and cover over. The holes are four feet apart, for here the maize grows to an immense height. The agricultural tools were of a most primitive kind. The ground is first broken and cleared with a bit of old iron, fastened, at an acute angle, on a short handle. It is further broken up by an attempt at a spade, an oblong piece of iron, bent at one end round a long pole. The weeds and brushwood are cleared away by an instrument like the first, only turned a different way, both being secured to their handles by leathern thongs. They reap with the blade of an old knife, and where the clods require to be broken up very fine, as in coca plantations, it is done by hand. The only use that Gironda puts his small supply of sugar-cane to, as yet, is making spirits and a small quantity of treacle. The cane is expressed by a very primitive mill of three upright rollers of hard wood, worked by a single capstan-bar and a mule, the juice flowing into

a gutter, and running thence, through a bamboo, into a large jar. The juice is then placed in two long canoes, hollow trunks of trees, where it is allowed to ferment. In about eight days the fermentation is over, and it is ready for distilling. This sugar-beer is called *huarapu*, and is rather good. The juice is then poured into a large jar, over an oven, and above the mouth of this jar he places the broken side of another smaller one, covering the joining round with mud. From the mouth of the second jar a bamboo is led through a large canoe to the mouth of a third jar. The fire is lighted in the oven, the canoe is filled with cold water to condense the vapour as it comes up through the bamboo, and the work of distilling begins; the clear colourless rum soon commencing to flow out of the bamboo into the receiving-jar. The sugar-cane is of the purplish-brown kind, which is said to ripen quickest.

Gironda also raises a few edible roots, such as *yucas* (*Jatophra manihot*), *aracachas*[328] (*Conium maculatum*), *camotes* or sweet potatoes, and *ocas*. He gave me the following information respecting the climate and seasons in the valley of Tambopata, which is worthy of attention, as this is the very centre of the *C. Calisaya* region.

January.—Incessant rain, with damp heat day and night. Sun never seen. Fruits ripen.

February.—Incessant rain and very hot. Sun never seen. A coca harvest.

March.—Less rain, hot days and nights, little sun. Bananas yield most during the rainy season.

April.—Less rain; hot, humid nights, and little sun in the daytime.

May.—A showery month, but little heavy rain. This is the month for planting coca and sugar-cane, and what is called the *michca*, or small sowing of maize, as well as yucas, aracachas, camotes, and other edible roots. Coffee-harvest begins.

June.—A dry hot month. Much sun and little rain. Coca-harvest early in the month. Oranges and paccays ripen. Cool nights, but a fierce heat during the day.

July.—The hottest and driest month, but with cool nights. Very few showers. Time for sowing gourds, pumpkins, and water-melons.

August.—Generally dry. Trees begin to bud. A month for planting.

September.—Rains begin. Time for blossoming of many trees. Coca-harvest.

October.—Rains increasing. Maize-harvest, and time for the "sembra grande," or great sowing of maize.

November.—Heavy rains. A coca-harvest.

December.—Heavy rains. Pumpkins ripen.

The inhabitants of the valley of Tambopata consist of Gironda, his two little boys, one Victorio Jovi, Villalba, and the *cascarillero* named Martinez. Another *cascarillero*, named Ximenes, has lately died. They live with their families at a place called Huaccay-churu, about half a mile up the Llami-llami river, where there are a few huts, and a small clearing. Gironda's little farm is the last inhabited spot; beyond is the illimitable virgin forest, stretching away for hundreds, nay thousands of miles, to the shores of the Atlantic. This forest has not been traversed since 1847, when the bark trade ceased, and it is quite closed up.

By the desertion of one of my Indians on the day we left Sandia, the other three and Pablo Sevallos were barely able to carry the provisions and other necessaries, so that, on reaching Gironda's clearing, which is called Lenco-huayccu,[329] I found that I had only sufficient food to last for six days. Gironda himself was little better off, and was living on roots, and *chuñus* or potatoes preserved by being frozen in the loftiest parts of the Andes. I determined, however, to penetrate into the forest, in search of chinchona-plants, for six days, and to trust to Gironda's kindness to supply me with provisions to enable me to return to Sandia.

I was so fortunate as to secure the services of Mariano Martinez, an experienced *cascarillero*, who had acted as guide to Dr. Weddell, on the occasion of his visit to the valley of Tambopata in 1846. He was thoroughly acquainted with all the different species of chinchona-trees, and, reared from a child in these forest solitudes, he was a most excellent and expert woodman, intelligent, sober, active, and obliging.

On May 1st we prepared to enter the dense entangled forest, where no European had been before, and no human being for upwards of thirteen years, except the Collahuayas and incense-collectors. Our party consisted of seven: the three Indians, Weir, Pablo, Martinez, and myself. The Indians, each with their *chuspas* of coca, and a *chumpi* or belt round their waists, carried the *ccepis* or bundles of provisions; Pablo bore the tent; and we were all armed with *machetes*, or wood-knives, to clear the way. My people were all dressed in coarse cotton cloth, and I wore a leathern hat, red woollen shirt, fustian trousers, and the indispensable *polccos*, or shoes made of *bayeta* or felt, always used in these forests. We were all mustered and ready to start on the verge of Gironda's clearing, which is surrounded by tall forest trees, with the river rushing noisily past, and the opposite mountains covered to their summits with fine timber, when half a dozen pale-faced men emerged from the tangled thicket in our front. They looked wan and cadaverous like men risen from the dead, and worn out by long watching and fatigue. They turned out to be Collahuayas, collectors of drugs and incense, who penetrate far into the forests to obtain their wares, and come forth, as we then saw them, looking pale and haggard.

These Collahuayas, called also Chirihuanos on the coast of Peru, Yungeños, and Charasanis, are a very peculiar race. They come from three villages in the forest-covered ravines of the Bolivian province of Larecaja, called Charasani, Consata, and Quirbe; and their knowledge of the virtues of herbs has been handed down from father to son from time immemorial. They traverse the forests of Bolivia and Caravaya collecting their drugs; and then set out as professors of the healing art, to exercise their calling in all parts of America, frequently being two and three years away from their homes, on these excursions. With their wallets of drugs on their backs, and dressed in black breeches, a red poncho, and broad-brimmed hat, they walk in a direct line from village to village, exercising their calling, and penetrating as far as Quito and Bogota in one direction, and to the extreme limits of the Argentine Republic in the other. Their ancestors did the same in the time of the Incas, and Garcilasso de la Vega gives some account of the medical treatment adopted by the ancient Peruvian physicians. They were in the habit of letting blood and purging, they administered the powdered leaf of the *sayri* (tobacco) for headaches, *mulli* (*Schinus molle*) for wounds, and a host of other simple herbs for other ailments. Both Garcilasso[330] and Acosta[331] mention their knowledge of the virtues of sarsaparilla, yet it is remarkable that the Collahuayas should never have discovered the febrifugal qualities of chinchona bark.

We saluted these hard-working physicians, and then entered the forest from which they had just emerged. A short walk brought us to the river Challuma,[332] a tributary of the Tambopata, which we waded across. Martinez told me that this was the extreme point reached by Dr. Weddell, and that he came here to see a tree of *C. micrantha* growing.

Beyond the Challuma there is no road at all, and the really serious forest work began; two hornets stinging me on the temple and back of the neck, as I forced my way through the first bush. Martinez went in front as pioneer, clearing away obstructions with his *machete*, and the rest of our little party followed. Between lordly trees of great height the ground was entirely choked up with creepers, fallen masses of tangled bamboo, and long tendrils which twisted round our ankles, and tripped us up at every step. Ten miles on open ground is only equal to one over such country as this. In many places we had to scramble through the same dense forest, along the verge of giddy precipices which overhung the river. Often we came upon tracks where a giant of the forest had fallen, bearing all before it, and finally dashing over the cliff into the river below. The Tambopata was boiling and surging over a rocky bed, at times far below us, while at others we took advantage of a short strip of rocky beach to escape the forest. Thus we struggled on until sunset, when we reached a stony beach, and encamped for the night. This had been a most fatiguing march. In some places we were a quarter of an hour forcing and cutting our way through a space of twenty yards, and the halt was most welcome. It was a wild scene as the darkness closed round: the camp-fire and Indians on the beach, the dense gloomy forest close behind, the boiling river in front, and forest-clad mountains rising up on the other side.

From this, the first day of our forest-life, until the 14th of May, being just a fortnight, we were actively engaged in the examination of the chinchona region, and in the collection of plants. As the best way of recording the results of our investigations, I now propose to give a detailed account of our proceedings from day to day; and, in the following chapter, to recapitulate our observations with special reference to the climate, soil, and general habit of those species of chinchonæ which came immediately under our notice. I owe much to the intelligent assistance of our guide Martinez, who, to great experience in woodcraft, added a lynx's eye for a *Calisaya*-plant; and it required no little quickness and penetration to distinguish these treasures, amidst the close entanglement of the undergrowth, in the dense forests. Martinez spoke Spanish very imperfectly, and, without a knowledge of Quichua, I should have found much difficulty in conversing with him; but he had a most complete and thorough knowledge of all forest-lore, and was acquainted with the native name of almost every plant, and with the uses to which they were or might be applied.

At dawn the Indians found the marks of a jaguar on the beach close to the tent; and a huge snake wriggled through the fallen trees as we re-entered the forest. The brilliant colours and great variety of butterflies were very striking. I particularly noticed one, bright blue and crimson above, with the underside marked with a pattern, as if drawn by a crow-quill on a snow-white ground, edged with deep blue. After struggling through the forest for about a mile we came to the foot of the tremendous precipices, one on either side of the river, which Martinez called Ccasa-sani. That on our (the western) shore rises up perpendicularly from the water to a height which we estimated at 500 feet, ending in a rocky peak. Its sides are masses of bare polished rock, except in the rear, and in some crevices, where vegetation finds a foothold. Amongst other trees the paccay (*Mimosa Inga*), with its cottony fruit, was drooping over the bubbling waves. The river, surging furiously over and around huge masses of rock, dashed noisily on between the two precipices.

We had to ascend the western precipice of Ccasa-sani by a frightful kind of ladder, formed of ledges in the rock, or half-rotten branches of trees, here and there having to cross a yawning chasm on the fallen stems of tree-ferns rotting from age. Near the summit we had a glorious view of the forest-covered mountains, running up into sharp peaks, with graceful palms rising above the other trees on their crests, and standing out against the sky. Several *Calisaya*-trees were growing on the summit, with bunches of young capsules, in company with the leathery-leafed *huaturu*, and the *Aceite de Maria* (*Elæagia Mariæ*, Wedd.). The latter is a tree about thirty feet high, with bark covered with white lichens. Among the numerous ferns the most conspicuous was a very large *Polypodium*, called *calaguala*. Descending the rocks of Ccasa-sani, we had to continue the work of cutting our way through the forest, our passage being opposed by matted entanglements of bamboo, and a *Panicum* with blades, the edges of which cut like a penknife, called *challi-challi*. On many of the trees there were hornets'-nests, globes of

mud fixed to the leaves, and covered with the insects. I was inadvertently going to touch one, which was attached to the back of a large fern-frond, when Martinez, with great dexterity, hurled the plants down the precipice, before the savage creatures were aware of their danger.

We were now in the midst of the chinchona region; and passed several trees of *C. ovata* (*morada ordinaria*) and *C. micrantha* (*verde paltaya*). There were also great quantities of a false chinchona, called by Martinez *Carhua-carhua blanca*. We passed through several large groves of this species, which appeared to be a *Lasionema*, but differed in several respects from the *L. chinchonoides*, mentioned by Dr. Weddell as growing in the Caravayan forests. The tree is very common near the banks of the river Tambopata, frequently with its boughs, large coarse leaves, and panicles of flowers, drooping over the water.[333]

The magnitude and variety of the trees of the forest were very striking; and the imposing character of the scenery, in these vast solitudes, was a source of constant enjoyment, and lightened the fatigues of the journey. Among the wonders of the forest there were enormous trees with great buttressed trunks, others sending down rope-like tendrils from the branches in every direction, the gigantic balsam-tree, the india-rubber tree, and many others. A list of the ferns or mosses, endless in the variety of their shape and size, would fill volumes. Of palms, also, there were many kinds. The tall *chonta*, with its hard serviceable wood; the slender beautiful *chinilla* (*Euterpe?*); the towering *muruna* (*Iriartea?*), with its roots shooting out in every direction from eight feet above the ground, and triangular-notched leaflets; the *chaquisapa* (*Astrocaryum?*), with its lofty stem thickly set with alternate rings of spines, and thorny leaves; the *sumballu* (*Giulielma?*), a beautiful palm with a slender stem covered with long sharp spines, numerous graceful leaves, and an edible fruit; and above all the *sayal*, the monarch of the palms of these forests, with a rather short thick stem, inner fibres of the stalks like black wool, but with enormous leaves growing rather erect from the stem to a length of at least forty feet—I should think they must be the largest leaves in the whole vegetable kingdom. Among the bright flowers there were crimson *Melastomaceæ*, called *ccesuara*, a scarlet *Justitia*, the *Manetia coccinea*, and many beautiful orchids in the branches of the trees.

At length, after a very hard day's work, we reached the mouth of the Yana-mayu[334] or Black river; and attempted to wade across the Tambopata, but found it too powerful. I was particularly anxious to effect this, as Martinez assured me that chinchona-trees were most abundant on the right or eastern bank. We, however, managed to get upon an island, near the left bank, and encamped for the night on a shingly beach. After sunset it came on to rain very heavily, and the waters foamed furiously around us in the inky darkness. The rain continued to pour down, and the waters to rise through the night, and I hourly expected the island to be submerged; but, fortunately, we escaped this danger,

though the river came up to within a very few feet of the tent-door. I served out a dram of brandy to all hands.

In the morning of May 3rd I continued my attempts to cross the river, by stripping and trying the water for a ford at several points, with a long pole as a support. But the water was deep, much swollen, and very rapid; and, after having twice been as nearly as possible carried away by the fury of the stream, I was obliged unwillingly to give up the attempt for the present. I considered it prudent also to remove our encampment from the island, and to establish it on a narrow beach overshadowed by the forest, at the point where the muddy waters of the Yana-mayu unite with those of the Tambopata.

These arrangements having been made, we devoted the day to an examination of the adjacent forest. The spot on which we were encamped was about 4600 feet above the sea. Our tent was pitched close to the foaming torrent, and behind rose up the tall dark forests. In front were the steep green sides of the Yana-mayu ravine, while looking down the river the view was bounded by forest-covered mountains, surmounted by the lofty peak of Corimamani. On the actual banks of the river there were trees of *C. micrantha*, with large bunches of lovely and deliciously sweet white flowers; many *carhua-carhua blancas*; and a chinchonaceous tree, which Martinez called *Huiñapu*. The *Huiñapu* grows low down and near the banks of rivers. Its capsules are three inches long; and the veins of the leaves are a pale purple. Dr. Weddell tells me that he recollects gathering the leaves of the *Huiñapu*, and that he took it to be a variety of *Cascarilla magnifolia*.

We commenced the day's work in the forest on the south-west slopes of the Yana-mayu ravine, scrambling up the steep forest-covered declivity amongst palms, tree-ferns, bamboos, and trees with buttressed trunks of stupendous size. Here too were the vast leaves of the *sayal* palm. At a height of 400 feet above the river the *Calisaya* region commences; while in the lower belt, from the river banks to a height of 400 feet, the most abundant chinchonaceous plant is the *Carhua-carhua grande* (*Cascarilla Carua*, Wedd.), with very fragrant white flowers. I met with flowers and capsules together on the same tree, which is forty feet high, with a thick trunk, fine spreading branches, and masses of beautiful white flowers.

I found that the *C. Calisaya* region extended in a belt from 450 to 650 feet above the banks of the river; bamboos, large palms, *C. micranthas*, *Huiñapus*, *Lasionemas*, and the *Cascarilla carua* being found below that line, and other species of chinchonæ and chinchonaceous plants above it. We collected twenty-five *Calisaya*-plants, two of them fine strong seedlings, and the remainder root-shoots springing up from trees which had been cut down by *cascarilleros* in former times, but with good spreading roots of their own. The search was exceedingly hard work, scrambling through matted undergrowth, and up steep ascents, through masses of rotting vegetation.

The afternoon was devoted to an examination of the heights on the north-east side of the Yana-mayu, where, at an elevation of 450 feet, there is a level table-land, covered with palms and bamboos. The search was chiefly conducted along a ridge above this plateau, where the bamboos ended. We obtained twenty more plants of *C. Calisaya*, one of which was declared by Martinez to be a *Calisaya morada* (*C. Boliviana*, Wedd.), and the leaf agreed well with Dr. Weddell's description, though that botanist believed that the species was not found in this part of Caravaya, but only in the valleys of Ayapata, further north. To-day we saw a couple of *tunquis*,[335] birds with the most gorgeous plumage I ever beheld. They are the size of large pigeons, with orange-scarlet feathers on the head, neck, breast, and tail, black wings, light-grey back, and scarlet crest. They have a shrill, harsh cry. The butterflies and moths were numerous and brilliant, but so tame, and in such swarms, as to be a perfect plague. There was one bright swallow-tail, with blue wings, fringed with crimson. The torments from venomous insects were maddening; especially from a kind of fly which in a moment raised swellings and blood-red lumps all over the hands and face, causing great pain and irritation. During the night it rained heavily, with peals of thunder, and vivid flashes of lightning, while the river increased in size, and roared past the tent noisily.

The collection of chinchona-plants was deposited in a shady place, near the tent, the roots being well covered over with soft moss.

On the morning of May 4th the river was so swollen as to destroy all hopes of crossing it for the present. It frequently changed its colour, on one morning the surging flood being black, on another tolerably clear, and on another a light muddy colour. By these means Martinez could always tell where the rains had been heaviest, and what stream was contributing an unusual freshet to swell the waters of the Tambopata.

I devoted the day to examining the forest on the declivities overhanging the left bank of the Tambopata, and this was by far the most toilsome and dangerous forest journey we had yet made, rendered worse by a comparative want of success. The whole way was along giddy precipices, seeming to hang half way between the sky and the roaring torrent, with no foothold but decaying leaves, nothing to grasp but rotten branches, every motion a drenching bath from wet leaves, every other step a painful and dangerous slip or fall, besides hornets, and endless thorns. Among the latter I was struck by a tree called *itapallu*, with trunk and branches thickly set with thorns, very large leaves, and the fruit in clusters, like bunches of pearls with purple stalks. We met with large pigeons, flocks of green parrots, paroquets, and tunquis. The forest peeps across the river were superb, but it was difficult to enjoy them. Martinez pointed out a small *Asplenium*, called *espincu*, which has a sweet taste, and is sometimes chewed by the Indians for want of coca; and the *panchi*, a tall slender malvaceous tree, with large round leaves on spreading branches at the top, and very white wood. It is used by the Chunchos for procuring fire by friction, and the bark, which peels off in long strips, is

serviceable for girdles. During this day we came to the largest *Calisaya* we had yet seen, and Martinez operated on the bark to show his dexterity as a cascarillero, which was remarkable.[336] Our collection only amounted to fourteen plants, among them two fine seedlings of *C. Calisaya*, two of *C. micrantha*, two of *C. ovata, var. β rufinervis*, and the remainder root-shoots of *C. Calisaya*: seedlings of the latter species are exceedingly rare. We returned to our camp dead beat, and drenched to the skin, only to find that my Indians were mutinous, declaring that they had been away long enough, that they had no maize or coca left, and that they must return to their homes at once. Our only hope rested upon them, and, if they had deserted, all our plans would have been entirely frustrated. It, however, required no little persuasion and eloquence to induce them to change their minds, and, as they had nothing left to eat, I sent Andres Vilca back to Gironda, to entreat him to supply us with a few chuñus and a little coca. I then told the others, in their own expressive language, that if they deserted me they were liars, thieves, traitors, and children of the Devil, whose punishment would soon overtake them; while if they were true to me they would be well rewarded, and would enjoy the friendship of a Viracocha. After this great effort in Quichua, the evening ended pleasantly. The Indians had built themselves a little shed of palm-leaves near the tent door, a bright fire was lighted, and its cheery reflection danced on the waves of the noisy flood.

It rained heavily through the night, and in the morning, hearing from Martinez that the varieties of *C. ovata*, the collection of which had been recommended to me by Dr. Weddell, were only found in a zone at a much greater elevation than that of the *C. Calisayas*, I devoted the day to a search in an almost vertical direction, on the north-east side of the Yana-mayu, towards some heights called Pacchani.

Ascending the steep sides of the ravine of Yana-mayu for about two hundred feet, we reached a narrow level shelf covered with ferns and the huge leaves of the *sayal* palm. The locality was very damp and shady, and the *C. micrantha*, *Huiñapu*, and *Cascarilla Carua* were in great abundance. We continued to ascend through the forest which covered the sides of the steep mountain, for several hours continuously; the footing consisting of decayed leaves and rotten trunks, moss and ferns covering every tree, and all the vegetation intensely humid. At a height of 750 feet above the river we came to some trees of the *beno-beno* (*Pimentelia gomphosia*,[337] Wedd.), with its bright laurel-like leaves and minute capsules; the *C. pubescens*, called by Martinez *cascarilla amarilla*, still only in bud, which was very abundant; and large trees of the *morada naranjada* (*C. ovata, var. α vulgaris*, Wedd.). Near this place a troop of about twenty monkeys went chattering along the tops of the trees, and while I was looking at them a huge black hornet rushed up out of the moss and stung me on the chin. These savage creatures make their nests under the earth, and are called *huancoyru*.

After a long and wearisome but fruitless search for young plants of the *zamba morada* (the *β rufinervis* variety of *C. ovata*) in these excessively damp forests, we began the descent again. Nothing struck me so much as the extraordinary variety of forms and shapes in which nature works in these tropical forests. One is amazed to see enormous trees with their gigantic roots separating at least twenty feet above the ground, and forming perfect Gothic arches. In one place a giant of the forest had grown on the edge of a ridge of rock, and the roots had combined with the stone to form a spacious vaulted cave large enough to hold ten men comfortably. Beautiful variegated leaves of *Colocasiæ*, and a scarlet-flowered *Justitia*, with bright purple leaves, united with a profusion of ferns to ornament the opening, while some tree-ferns, and a *chinilla*, the most slender and elegant of the palms of the forest, guarded the entrance. Rays of the sun struggled through a network of bamboos on an opposite bank, and penetrated into the recesses of the cavern. While I gazed on this lovely scene, the plaintive mournful notes of the little "*Alma perdida*" reached me from the boughs of the great tree. This is a small bird of the finch tribe, of which there are two kinds, one black, the other chesnut with black wings. Their loud clear note is peculiarly sad. Such peeps as these into the secret beauties of the innermost forest recesses are rewards for many hours of toil and disappointment.

Late in the evening I returned to the tent dead tired, sodden and wet to the skin, covered with moss and fungus, bitten all over by mosquitos, stung by a hornet, and with hands sliced in pieces by the sharp blades of a *Panicum* called *challi-challi*, but with only three plants of the valuable variety of *C. ovata*. It is most provoking that only the seedlings of all the worthless species of Chinchonæ should be in great abundance; the reason is of course connected with the general felling of the trees of valuable species by the cascarilleros, years ago.

There was little rain during the night, and on May 6th we commenced the search of a range of forest on the south-west side of the Yana-mayu ravine, where we found a large supply of plants of *C. Calisaya*. At a height of 500 feet above the river there was a ridge of rock jutting out from the forest-covered sides of the ravine. In this spot the ground was not nearly so thickly covered with vegetation; there were no palms, tree-ferns, or plants requiring extreme moisture, and young plants received shade from taller trees, while they also enjoyed plenty of sunshine through the spreading branches. The most abundant plants were *Melastomas*, *huaturus*, and *Panica*, which climb amongst the branches to a height of thirty feet and upwards. These afford but very slight shade, and below there is an undergrowth of ferns, *Colocasiæ*, and young plants. In different parts of this ridge we collected 124 young *C. Calisaya* plants, most of them root-shoots, and a few seedlings. There were also two young trees bearing capsules. The *C. Calisaya* plants were all growing out of the moss which covered the rock to a thickness of eight inches or a foot, together with beautiful *Hymenophylla*,[338] but there was scarcely any soil. The roots spread along the face of the rock, which is a metamorphic

clay slate, unfossiliferous, slightly micaceous, and ferruginous;[339] and is easily broken up into thin layers by the growth of the plants. In this situation the *C. Calisayas* were more numerous than in any other we have yet seen.

Two bears had made themselves a comfortable and very carefully prepared bed on the summit of the ridge, whence there was an extensive bird's-eye view of the windings of the river, and of the forest-covered mountains beyond. On the opposite mountains there were two or three long bare places—tremendous landslips, not unfrequent occurrences in the forest. There is a sudden crash, when masses of rock, huge trees, and underwood come rushing down in one fell irresistible swoop. A beautiful white *Stephanotis* was climbing over the rocks. We returned to the camp in a heavy fall of rain, after a very severe but successful day's work, and found that both the Indians and ourselves had come to the end of our provisions, and that Andres Vilca Lad not returned.

On May 7th we rose to find only a few bread-crumbs in the corner of our bag, and, as famine was thus knocking at the door, it became necessary to beat a hasty retreat. The plants were carefully packed in layers of moss, and sown up in two bundles of Russia matting, which we had brought with us, containing about 200 chinchona-plants. In the absence of Andres Vilca, Mr. Weir showed much zeal and energy in undertaking to carry one of these bundles, four and a half feet in circumference, over the slippery and dangerous road, in doing which he fell into the river.

On the morning of May 7th, when we commenced our retreat, it was pouring with rain, and the forest was saturated, our bodies sodden, our hands crumpled like washerwomen's, and our powder damp. We had to wade across many little streams falling into the Tambopata. The first, after leaving the Yana-mayu, was called Churu-bamba, because it empties itself just opposite an island (*churu*, in Quichua). The next stream was *Uma-yuyu*, *uma* being water in Aymara, and *yuyu* a plant with a large cordate dock-like leaf, used in *chupes*. Thus every little stream and hill had received a name from the cascarilleros of former times, from some peculiarity of position or other similar circumstance, which would easily impress it on the memory. What an improvement on the nomenclature in new countries discovered by Englishmen, where we have an endless succession of Jones's rivers, Smith's mountains, and Brown's islands! Near the banks of these streams there are very large snail-shells, and Martinez described the snails as "large kind of hornets, all made of flesh, which do not sting." He called them *Mamachuru*, or "Mother of the Island."

On reaching the precipice of Ccasa-sani we scrambled along its slippery sides, in the pouring rain, to collect plants of *C. Calisaya*, and obtained twenty-one good ones. They were growing in a similar situation to those above the Yana-mayu, in company with a number of *Aceite de Maria* trees (*Elæagia Mariæ*),[340] and completely exposed to the sun, without any shade whatever. Passing the precipice, we continued our damp weary journey, Martinez pointing out everything that was noticeable by the way, especially the

palo santo (*Guaiacum sanctum*), a very tall tree, the stem 60 to 70 feet high, without a branch, with a few short horizontally spreading branches at the summit, with pinnate leaves. When the bark is cut, a host of stinging ants come forth. There was also a plant, which he called *achira silvestre* (*Canna achira?*) with a rhizome, and bunches of rank red berries. We passed through groves of paccays (*Mimosa Inga*), a creeping legume with bright flowers, wild coca, many *Lasionemas*, with their large coarse leaves drooping over the river, and a melastomaceous plant with a crimson fruit. After having been nearly carried away by the force of the Challuma river, in wading across it, I reached Gironda's hospitable shed, after a journey of more than thirty miles, in pouring rain.

On May 8th I left Gironda's clearing, with Martinez, in order to examine the forests above the hut of Tambopata, for plants of *C. Calisaya*. Here, in almost exactly a similar ridge of rock to those which proved so prolific of these precious plants on the heights above the Yana-mayu, and on the precipice of Ccasa-sani, I found a number of plants of *Calisaya morada* (*C. Boliviana*, Wedd.), growing out of moss, amongst the rocks, with scarcely any soil. They were overshadowed by numerous trees, called by Martinez "Compadre[341] de Calisaya" (*Gomphosia chlorantha*, Wedd.), one of the most graceful and beautiful of the chinchonaceous plants, with deliciously sweet flowers. Dr. Weddell exactly describes it as rising without a branch above all the trees of the forest, and then spreading out in the form of a chandelier, and attracting the attention of the traveller from afar. The bark of this tree, with its transverse cracks, can with difficulty be distinguished from that of *C. Calisaya*. Whilst climbing amongst these rocks, I nearly put my hand on a small viper of a most venomous kind, 18 inches long, with a black skin marked with yellow rings, edged with white. In the evening we returned to Gironda's clearing at Lenco-huayccu, with eighty-seven chinchona-plants, sixteen of Calisaya fina (*C. Calisaya, var. α vera*), and sixty-nine of Calisaya morada (*C. Boliviana*, Wedd.).

We found Gironda, on whom we were now entirely dependent for food, very little better off than ourselves. His supplies consisted of maize, yucas, aracachas, chuñus or frozen potatoes, and quispiñas, made of boiled quinoa-grains dried in the sun, ground, and preserved as little gritty hard lumps. He also had some *achocches*, which are poor watery cucurbitaceous things, squeezed, and served up in chupes. No salt.

Though frequently baffled, and more than once exposed to much risk in making vain attempts, I had never given up my determination to have at least one day's work on the right bank of the Tambopata. For some days the volume of water had been gradually decreasing, but it was still 40 yards across, and rushing with great velocity over a ford which Gironda believed to exist a little below Lenco-huayccu. I stripped and went in, with the stem of a young *chonta* palm as a support, but, on approaching the mid-channel, the water came up above my middle, the large pebbles slipped and rolled under my feet,

and for some time it was with the utmost difficulty that I held my own; but finally we all reached the right bank in safety.

We were rewarded by a very successful day's work. After ascending the steep ravine, through the zone of bamboos, to a height of 400 feet, we reached a ridge of rocks, where we collected 109 good chinchona-plants of the *Calisaya morada* species. The leaves of the chinchonæ, and more especially the *Calisaya* species, are invariably perforated by holes in every direction. Much of this mischief is the work of caterpillars, but it may partly be attributed to the effects of drip from the trees which overshadow them. In this forest there were trees of great height, without a branch for a distance of 50 or 60 feet from the ground, which Martinez called *canela*. The inner bark had a strong taste of cinnamon, and they use it to scent and flavour their *huarapu*, or fermented juice of the sugar-cane. On many trees, in the forest, there are immense masses of earth fixed on the trunk, called *cotocuro*. They consist of exceedingly thin layers, one added to another until they are sometimes of an immense size, eight to ten feet high, and three or four feet across. They are made by myriads and myriads of small yellowish lice, which swarm between each thin layer.

In the evening we incurred the same risks in wading across the river again, but arrived without any accident at Gironda's clearing, where we now had a depôt of 436 chinchona-plants.

On May 10th I resolved to make a search on the heights immediately above Lenco-huayccu, called Gloriapata, for the valuable red-nerved variety of *C. ovata*. I first paid a visit to the poor little Indian wife and children of Martinez at Huaccay-churu, in a hut of split bamboos, surrounded by aracachas, yucas, camotes with their white convolvulus flowers, plantains, frijoles or beans, and the *Amaranthus caudatus*, which they call *jataccu* and *cuimi*, using the leaves in *chupes*. We then struck right up the steep declivity of Gloriapata, making our way with difficulty through the dense bamboo thickets, which, in spite of their obstinate obstructiveness, make excellent cisterns, and their joints will always afford a good drink of cool water. For some time we followed a pathway made by a herd of peccaries, until it ended at the mouth of a cave which, though low, appeared to be of considerable size. These peccaries come down in herds of thirty or forty to the clearings, during the night, and do much damage amongst the roots. Some are black and white, and others of a leaden colour.

After ascending for several hundred feet we came to trees of *C. pubescens*, which appear to belong to a zone just below, but in contact with the *C. ovatæ*. Their leaves were eaten by a caterpillar, red at both ends, with a horn, red stripe down the back, and red spots on each side, body striped green and yellow. Some hundred feet higher there were large trees of both varieties of *C. ovata*, growing in very moist parts of the forest, where the trees were covered with *Hymenophylla* and dripping moss, the former a sure sign of extreme humidity. The ground was covered with fallen leaves to a great depth,

and there was a good deal of shade. We collected seven plants of *C. ovata, var. α vulgaris*, and eleven of *C. ovata, var. β rufinervis*, five of which were strong healthy seedlings, the remainder being suckers, with spreading roots of their own. With the *C. ovatæ* grows the *Carhua-carhua chica* (*Cascarilla bullata*, Wedd.).

In descending from these heights I came to a tree which Martinez called *copal*, but the trunk rose to such an extraordinary height, without branches, that I was unable to make out the appearance of the leaves or flowers. The bark was covered with a milk-white fragrant resin, of a nature analogous to *gum thus* or *gum elemi*. The forest also abounds in vegetable and bees' wax, and in many varieties of gums and resins.

On May 11th, as we had now collected a sufficient number of chinchona-plants, including those of the shrub *Calisaya* which we intended to take up on our return across the *pajonales*, to fill the Wardian cases at Islay, Mr. Weir began to make up the plants in layers, with plenty of moss between them, ready for sewing up in the Russia matting. Having heard that a young man, a nephew of Gironda's, had planted a *C. Calisaya* in a small clearing a few leagues up the ravine, I went to examine it. The clearing was on a steep declivity sloping down to the river, and had been partly planted with coffee and coca by its solitary occupant. The tree was a *Calisaya morada*, having been a root-shoot twelve inches high when it was planted in January, 1859. It is now seven feet high, six inches and four-tenths in circumference round the trunk, and three feet three inches across the longest branches from one side of the stem to the other. It was growing on the side of a steep hill, quite open to the south, east, and south-east, at the edge of a clearing, while mountains covered with forest rise up close behind it, on the north and west, to a great height. It is planted in a soil consisting of stiff yellowish loam, composed of vegetable matter, mixed with the disintegration of the soft clay slate. This is probably the only cultivated chinchona-tree in Peru. In returning to Lenco-huayccu I saw a flock of *Alectors*, large birds analogous to turkeys, and many parrots; and on my arrival I found that Mr. Weir had already made up the chinchona-plants, in four Russia-matting bundles, ready to start for Sandia on the following morning.

CHAPTER XVI.

GENERAL REMARKS ON THE CHINCHONA-PLANTS OF CARAVAYA.

THE range of my observations in the chinchona-forests extended for a distance of forty miles along the western side of the ravine of Tambopata, and one day's journey on the eastern side. This region is covered, with few exceptions, from the banks of the river to the summits of the mountain-peaks, by a dense tropical forest. The formation is everywhere, as I have before said, an unfossiliferous, micaceous, slightly ferruginous, metamorphic clay-slate, with veins of quartz, and the streams all contain more or less gold-dust. When exposed to the weather this clay-slate quickly turns to a sticky yellow mud,[342] and lower down it is very brittle, and easily breaks off in thin layers. The soil formed by the disintegration of the rock, mixed with decayed vegetable matter, is a heavy yellowish brown loam, but there is very little of it on the rocky sides of the ravine, and no depth of soil except on the few level spaces and gentle slopes near the banks of the river. Mr. Forbes, in speaking of the extensive range of Silurian formation, of which the Tambopata hills form a part, attributes the frequent occurrence of veins of auriferous quartz, usually associated with iron pyrites, to the proximity of granite, whence they have been injected into the Silurian slates. In the cooling and solidification of granite the quartz is the last mineral element to crystallize and become solid, and he suggests that, during the cooling, the consequent expansion due to the crystallization of the constituents has forced the quartz and gold, still fluid, into the fissures of the neighbouring rocks, and so formed the auriferous quartz veins. These are only developed in the slate rocks, which, when such veins occur, must be at no great distance from granitic eruptions, either visible, or such as may be inferred to exist.[343]

The chinchona forests which I examined in the Tambopata valley are between lat. 13° and 12° 30′ S. The elevation above the sea, on the banks of the river, is 4200 feet, while the loftiest crests of the mountains which overhang it on either side attain an elevation of about 5000 feet. In the preceding chapter I have given a general idea of the nature of the climate throughout the year, and my stay was too short to enable me to give any more detailed information for most of the months; but I did not fail to take careful observations while I remained in the valley, which will give an accurate idea of the climate during the month of May. During the fourteen first days of May the results were as follows:—

Mean temperature	69⅝° Fahr.	
,, ,, at 7 A.M.	68	
,, ,, at 3 P.M.	71½	
,, ,, at 9 P.M.	69	
Mean minimum in the night	62⅜	
Highest temperature observed	75	
Lowest ,, ,, ...	56	
Entire range	19	
Mean variation in the 24 hours	10⅛	
Greatest ,, ,, ...	15	
Least ,, ,, ...	6	
Mean of the dew-point	61⅝	
,, ,, at 7 A.M.	61·9	Dry bulb as above.
,, ,, at 3 P.M.	62·5	
,, ,, at 9 P.M.	60·9	

The wind generally blows up the valley during the daytime, when the clouds ascend, to be condensed by the colder night-air. Thus we almost invariably had rain at night, generally in a heavy fall, but occasionally in small drizzle, which usually continued until the forenoon. At noon it cleared up for a fine afternoon, and only on two occasions did we have rain throughout the day. The valley, and the course of the river, bear N.N.W. and S.S.E.

The three valuable species of chinchonæ found in Tambopata grow in distinct zones as regards elevation, together with other chinchonaceous plants, up the declivitous sides of the ravine.

From the banks of the river to about 400 feet up the mountains, the forest consists of bamboos, several genera of palms, tree-ferns, paccays, and other *Leguminosæ*, *Lasionemas*, *Cascarilla Caruas*, and the *Chinchona micrantha*, together with the chinchonaceous tree called by Martinez *Huiñapu*. This is the lower zone. The *C. micrantha*, called by Martinez *verde paltaya* and *motosolo*,[344] was in flower in May. I met with it constantly in moist low places; and several trees, with their very large ovate leaves, and bunches of white fragrant flowers, were actually drooped over the waters of the river. It produces a good quality of bark, and I collected seven fine seedling-plants of this species.

From 400 to 600 feet above the river is the middle zone, and that which contains the Calisaya-plants. The vegetation chiefly consists of huge balsam and India-rubber trees, *huaturus*, *Melastomaceæ*, Aceite de Maria (*Elæagia Mariæ*), Compadre de Calisaya (*Gomphosia chlorantha*), and occasional trees of *Cascarilla Carua*, which straggle up from the lower zone. Here the young trees of *C. Calisaya* grow in great abundance, but the cascarilleros had certainly done their work well in former years, for every single tree of any size had been felled, though many of the young root-shoots were 20 and 30 feet high, and covered with capsule-bearing panicles. These precious trees were most plentiful under the ridges of rock which crop out at intervals, where the ground was not

so thickly covered with vegetation, and where the young plants obtained plenty of light and air, while they were partially protected from the direct rays of the sun by the spreading branches of taller trees. The *Calisaya*-trees, on the Ccasa-sani precipice, however, had no shade whatever. They were covered with capsules. I observed that when the young plants of *C. Calisaya* grew up the sides of the rocks, and actually came in contact, they often threw out roots from their stems or branches. The *C. Calisaya* is by far the most beautiful tree of these forests. Its leaves are of a dark rich green, smooth and shining, with crimson veins, and a green petiole edged with red, and the deliciously sweet bunches of flowers are white, with rose-coloured laciniæ, edged with white marginal hairs. But it was evident that we did not see them to advantage in these forests; they ran up tall and straggling, as if seeking the sun, and seemed to pant for more light and air, and a deeper and richer soil. Martinez told me that, when the Calisaya is much overshadowed by other trees, it loses the crimson colour on the petioles and veins of the leaves; and that fifteen leagues lower down the river (I suppose at about four thousand feet above the sea) the leaves of the *Calisaya morada* become quite bright purple all over the under side.

Gironda and Martinez told me that there were three kinds of Calisaya-trees; namely, the *Calisaya fina* (*C. Calisaya, α vera*, Wedd.), the *Calisaya morada* (*C. Boliviana*, Wedd.), and the tall *Calisaya verde*. They added that the latter was a very large tree, without any red colour in the veins of the leaves, and generally growing far down the valleys, almost in the open plain. A tree of this variety yields six or seven quintals of bark, while the *Calisaya fina* only yields three or four quintals; and Gironda declared that he had seen one, in the province of Munecas in Bolivia, which had yielded ten quintals of *tabla* or trunk-bark alone.

My remarks respecting the position of *C. Calisaya* trees, on the sides of the ravine, only apply to the forest below Lenco-huayccu; above that position they are not found so high up the sides of the mountains, probably owing to their greater proximity to the snowy region of the cordillera. The nearest snow may be about forty miles from Lenco-huayccu, as the crow flies. I also found that the *Calisaya fina* was most abundant about the Yana-mayu, while the variety called *morada* was plentiful in the upper part of the ravine. But it was very difficult for an unpractised eye to detect the slightest difference between these two varieties, until their leaves were placed side by side, when that of the *morada* appeared to be just a shade darker green. Dr. Weddell has, in his work, named the *Calisaya morada*, as a distinct species, *C. Boliviana*, but I understand that he is now of opinion that it is scarcely more than a variety of the *Calisaya vera*, its bark being very generally collected and sold as that of the latter. No plants which I saw in the forests could be compared, for vigour and regularity of growth, with the tree which I have already described as having been planted on the edge of a clearing; and I think this tends to prove that plenty of light and air is essential to the vigorous growth of the *C. Calisaya*, so long as there is a sufficient supply of moisture, and protection from the

direct rays of a scorching sun for the first year or two. The *C. Calisaya* is undoubtedly the most delicate and sensitive of all the species of chinchona.

Above the region occupied by *C. Calisayas*, in the forests, is the third or upper zone, from 600 to 800 feet above the river. Here, amidst very dense humid vegetation, covered with ferns and mosses, are first met the trees of *C. pubescens*, and *Pimentelia glomerata*, and a little higher up are numerous trees of the two valuable species of *C. ovata*, namely, α *vulgaris* and β *rufinervis*, with very large ovate leaves, the latter being distinguishable by the deep red of the leaf-veins. The *Cascarilla bullata* grows with them, and extends still higher up the sides of the mountains. The bark of the β *rufinervis* variety is habitually used to adulterate the Calisaya, which it very closely resembles, and is called *zamba morada* by the cascarilleros, while the α *vulgaris* variety is known as *morada ordinaria*. Martinez said that the *zamba morada* was very tenacious of life, and that, having once thrown away a branch amongst some moss, he found it a fortnight afterwards, still throwing out shoots. Both varieties of *C. ovata* yield valuable barks.

Above the zone of the *C. ovatas*, and nearer the snowy cordillera (for lower down the valley the forests cover the crests of the mountains), commence the open grassy *pajonales*, which I have already described. Here the formation is exactly the same as that in the valley of Tambopata; and the vegetation of the thickets which fill the gullies, and are interspersed over the grassy glades, consists of *huaturus*, *Gaultheriæ*, *Vacciniæ*, *Lasiandræ*, and other *Melastomaceæ*, *Chinchonæ*, palms, and tree-ferns. The chinchonæ consist of *C. Caravayensis*, and of the shrubby variety of *C. Calisaya*, which is called *ychu cascarilla* by the natives. The shrub *Calisaya* (β *Josephiana*) is generally from six and a half to ten feet high, but I met with an individual plant which I believe to belong to this variety, which had attained a height of eighteen and a half feet; and this inclined me to think, at the time, that this shrubby form could not even be considered as a variety of the normal *C. Calisaya*, and that its more lowly habit was merely due to the higher elevation and more rigorous climate in which it grew. Dr. Weddell remarks that its appearance varies very much according to the situation in which it grows, and that the colour and texture of the different parts change according to the amount of exposure.

I found the shrub *Calisaya* in flower in the end of April.

We crossed two *pajonal* regions, one above the valley of Sandia, and the other between the valleys of Sandia and Tambopata. The height of the former above the level of the sea was 5422 feet, and of the latter 5600 feet. The time of my visit was the end of April and beginning of May, and I traversed both regions twice, so that an abstract of my meteorological observations will give a tolerably correct idea of the climate at that time of the year; although they only extend over the 25th, 26th, 27th, and 28th of April, and a few days in the middle of May.

Mean temperature	59° Fahr.
Mean minimum at night	52
Highest temperature observed	67
Lowest temperature observed	49
Entire range	18
Mean of the dew-point	53.6 (dry bulb as above).

In the early morning there were generally masses of white clouds lying in the ravines, and in the afternoon a thick mist drifted across the *pajonal*, with drizzling rain.

The shrub-Calisayas, which were growing plentifully by the roadside, above the valley of Sandia, were entirely exposed, without any shade whatever, and the hill on which they grew had a western aspect. There is a difference in elevation of about 1000 feet between the locality where we saw the shrub-Calisayas, and the region of the normal tree-Calisaya in the Tambopata forests; and the shrubby form is also many leagues nearer the snows of the cordillera. These circumstances are alone sufficient to account for the difference in the habit of these two forms of *C. Calisaya*; and there seems to be no doubt that the barks of the shrubby varieties of chinchonæ are specially good when their stunted growth is owing to the altitude of the locality.

Our collection of chinchona-plants in the Tambopata forests, and on the *pajonales*, was completed on May 14th, as follows:—

	No. of Plants.
C. Calisaya (*calisaya fina*)	237
C. Boliviana (*calisaya morada*)	185
C. ovata, var. α vulgaris (*zamba ordinaria*)	9
C. ovata, var. β rufinervis (*zamba morada*)	16
C. micrantha (*verde paltaya*)	7
C. Calisaya, var. β Josephiana (*ychu cascarilla*)	75
Total	529

CHAPTER XVII.

JOURNEY FROM THE FORESTS OF TAMBOPATA TO THE PORT OF ISLAY.

Establishment of the plants in Wardian cases.

On May 11th Mr. Weir completed the packing of the plants, and we were preparing for the journey up into the *pajonales* on the following day, having previously fixed on the *Calisaya*-trees from which we intended to obtain a supply of seeds in August, when Gironda received an ominous letter from Don José Mariano Bobadilla, the Alcalde Municipal of Quiaca, ordering him to prevent me from taking away a single plant; to arrest both myself and the person who had acted as my guide; and to send us to Quiaca. [345] I found that an outcry against my proceedings had been raised by Don Manuel Martel, the red-faced man whom I had met on the road to Sandia, and that the people of Sandia and Quiaca had been excited by assertions that the exportation of cascarilla-seeds would prove the ruin of themselves and their descendants. Gironda, though friendly and hospitable, feared that the finger of scorn would be pointed at him, as the man who had allowed the stranger to injure his countrymen. He wanted to throw away all the plants, except a few which we might take without observation, and, if we had not kept constant guard over them, he would have carried his views into effect without consulting us. I saw that in an immediate retreat was the only hope of saving the plants; and I explained to Gironda that his views were incorrect, and that, if necessary, we were prepared to defend our property by force.

At the same time I addressed a letter to Don José Bobadilla, stating that his interference was an unwarrantable step which I would not tolerate; and that, as I understood the provisions of the Constitution of 1856, the functions of the *Juntas Municipales* were purely consultative and legislative, conferring no executive powers whatever, concluding with an expression of my sense of his patriotic zeal, and of regret that it should be accompanied by such misguided and lamentable ignorance of the true interests of his country. Nevertheless, I felt the imperative necessity of immediate flight, especially as I obtained information from an Indian of Quiaca that Martel's son and his party, who had brought the letter, were only the vanguard of a body of mestizos, who were coming down the valley to seize me, and destroy my collection of chinchona-plants.

Early in the morning of May 12th we took leave of our kind and hospitable old friend Gironda, without whose assistance we should have been exposed to much suffering from want of food; and of the honest forester Martinez. I expressed my sincere regret to Gironda that any misunderstanding should have arisen at the close of our acquaintance,

and promised Martinez to obtain guarantees that he should suffer no molestation on account of the services he had rendered to me. The most melancholy part of travelling is the parting with friends, never to meet again.

After a laborious ascent through the forest we found Martel's son and his party stationed on the verge of the *pajonal*. They were evidently waiting for us, but did not attempt to impede our passage, and a display of my revolver, although it may have been very efficacious, was perfectly harmless, as the powder was quite damp. The young Martel asked the Indians in Quichua how they dared to carry the plants, and called after them that they would be seized at Sandia; but he was civil to me, and we continued our journey peaceably, though full of apprehensions at the turn affairs might take on our arrival at Sandia.

We had to cross the same country as we had traversed in our journey to the Tambopata valley; and, in skirting along the verge of a ridge, near the Marun-kunka, the cargo-mule fell headlong down a precipice of twenty feet, into a dense mass of trees and underwood. We could see the poor beast's legs kicking in the air, but it was long before we could reach her, and more than two hours before a circuitous path could be cut and cleared away to extricate her. We encamped on the pajonal, and next day, after a very laborious walk of twelve hours, we reached the Ypara tambo, in the valley of Sandia, Mr. Weir having collected twenty plants of *Calisaya Josephiana* on the way. On May 14th we continued our journey towards Sandia, and collected fifty-five more plants of *Calisaya Josephiana* on the pajonal of Paccay-samana, chiefly seedlings.

The water of the numerous cascades is very refreshing, and as beautiful in its limpid transparency as when it dashes down the rocks in dazzling streams of purest white. We were now too in the land of luscious oranges and chirimoyas. The commonest bird in the valley of Sandia is the *cuchu*, a kind of large crow, with a shrill weak caw. It has a long yellow bill, greenish-brown body and wings, rump-feathers red, and a long bright yellow tail, with a black line down the centre. The *cuchus* walk about the fields eating the young maize, and perch upon the adjoining trees. Humming-birds are numerous, and very beautiful; I saw also a little cream-coloured hawk, and lordly eagles were soaring over the ravine, having their eyries in the inaccessible parts of the lofty cliffs. Approaching Sandia in the early morning of May 15th, I came upon many groups of Indians, with their wives and daughters, who had slept in the road, on their way to and from their coca-harvests. They were boiling their breakfasts of potatoes over little fires of dry sticks, which crackled pleasantly. Grand precipices towered up on either side of the valley, and in the bottom, where the bright river was murmuring on its way, there was a hut in a field of maize, surrounded by the drooping crimson flowers of the "love-lies-bleeding," with a girl in a bright blue woollen dress sitting at the door.

On arriving at Sandia I went through the ceremony of paying off my Indians, and taking leave; and Vilca, Ccuri, and Quispi returned to their homes. I formed a very high

opinion of the Indian character from my experience with these my fellow-labourers. Suspicious they certainly were at times, and with good reason after the treatment they have usually met with from white men, but willing, hard-working, intelligent, good-humoured, always ready to help each other, quick in forming the encampments, conversing quietly and without noise round the camp-fires, and always kind to animals; altogether very efficient and companionable people.

I found things at Sandia in a very alarming state; most of the people had been excited by letters from Quiaca to prevent me from continuing my journey with the chinchona-plants, and a sort of league had been made with other *Juntas Municipales* to protect their interests, and prevent foreigners from injuring them. The tactics which were adopted would have succeeded in their object, but for a great piece of good luck. I was prevented from hiring mules, except to go to Crucero, where I knew Martel was stationed, with the intention of raising obstacles to my further progress until the plants had been killed by the frost. I was in despair, and meditated setting out on foot, with all the four bundles of plants on my own mule, when Don Manuel Mena told me confidentially that, if I would give him my gun, he would get an Indian to supply beasts, and accompany me to Vilque, on the road to Arequipa. I willingly agreed to this bargain, and sent Mr. Weir and Pablo to Crucero, so as to throw Martel off the scent, while I hurried the plants down to the coast by the most unfrequented line of country.

An alarm had, however, been spread through all the villages bordering on the chinchona forests, both in Caravaya and Bolivia, and I ascertained that effectual measures had been taken to prevent my return for seeds in August. Martel had also written to the towns and villages between Crucero and Arequipa, to put obstacles in the way of my retreat, so that I found it necessary to avoid entering any town or village, and to shape a direct compass-course over the cordilleras from Sandia to Vilque. I also reluctantly abandoned my intention of returning to collect seeds in August, and made the best arrangements in my power to obtain a supply, through a reliable agent, in the ensuing year. Martel was a mischievous meddling fellow, but the members of the *Juntas Municipales* may have been influenced by misguided zeal for the interests of their country, and for the preservation of a strict monopoly in a trade which has ceased to exist, for no bark is now-exported from Caravaya.

In the morning of May 17th I left Sandia on my own trusty mule, driving two others with the plants before me, and accompanied by their owner on foot, an Indian named Angelino Paco, a middle-aged respectable-looking man, who had been one of the Alcaldes of Sandia in 1859. Mr. Weir started for Arequipa on the same day, by way of Crucero. Passing through Cuyo-cuyo without stopping, I continued to ascend a mountain-gorge, by the side of the stream, but Paco had never been out of the valley of Sandia before, and was useless as a guide. All along the banks of the stream there were square pools dammed up and filled with heaps of potatoes and ocas, placed there to

freeze into *chuñus*, the principal food of the Indians when in the forests, or on the coffee or coca estates. Higher up the gorge all signs of habitation cease, though there are still abandoned tiers of ancient terraces, and the mountain scenery is quite magnificent. Night coming on without a moon, I halted under a splendid range of frowning black cliffs, and succeeded in pitching the tent in the dark, but there was no fuel, and on opening the leathern bag I found that my little stock of food and lucifer-matches had been stolen in Sandia. I was thus entirely dependent for existence on Paco's parched maize, which proved uncommonly hard fare. The cold was intense during the night, and penetrated through the tent and clothes to the very marrow.

At daybreak Paco and I loaded the mules, and continued to ascend the gorge by the side of the river of Sandia, which becomes a noisy little rill, and finally falls, as a thin silvery cascade, over a black cliff. Reaching the summit of the snowy cordillera of Caravaya, we commenced the journey over lofty grass-covered plains, where the ground was covered with stiff white frost. There were flocks of vicuñas on the plain, and *huallatas*, large white geese with brown wings and red legs, on the banks of the streams; but as we advanced even these signs of life ceased, and, when night closed in, I looked round on the desolate scene, and thought that to make a direct cut across the cordilleras to Vilque by compass-course was a very disagreeable way of travelling, though, in this case, a necessary one. I had been eleven hours in the saddle, when Paco found an abandoned shepherd's hut, built of loose stones, three feet high, and thatched with *ychu* grass. The minimum thermometer, during the night, was as low as 20° Fahr. by my side.

At daylight on May 19th Paco complained of having to rise before the sun, although he must have been half-frozen. The mules had escaped, and we were fully three hours in catching them. The ground was covered with a crisp frost, and during the forenoon we were traveling over the same lofty wilderness, consisting of grassy undulating hills, with ridges of cliffs, and huge boulders here and there. The view was bounded on the north and east by the splendid snowy peaks of the Caravayan range, and to the north-west by those of Vilcañota. The only living things, in these wild solitudes, are the graceful *vicuñas*, which peered at us with their long necks from behind the grassy slopes, the *guanacos*, the *biscaches* burrowing amongst the rocks, and the *huallatas* or large geese on the margins of streams or pools of water.

At about noon we began to descend a rocky dangerous cuesta, where there was much trouble with the mules, which were constantly attempting to lie down and roll with the plants. The steep descent led into the plain of Putina, which was covered with flocks of sheep, with small farms, shaded by clumps of *queñua*-trees, nestling under the sandstone cliffs which bound the plain. Crossing another range, we reached a swampy plain, with sheep and cattle scattered over it, and stopped at an abandoned shepherd's hut, the exact counterpart of last night's lodging. I had been ten hours in the saddle, and

was faint from hunger, but had to go supperless to bed. Paco was nearly breaking down from a bad wound in his foot, but I bandaged it with lint, and he was able to proceed. He had an *alco* or Peruvian dog with him, which was devotedly attached to its master. These dogs are something like Newfoundlands, only much smaller, generally black or white, and seldom bark.

On the morrow the way, for the first two hours, led over grassy hills covered with flocks of sheep, with shepherd-lads playing on *pincullus*, or flutes, the sound of which came floating pleasantly on the air, from every direction far and near. We passed several blue mountain-lakes, with islands of rushes, and many ducks. From 10 A.M. until sunset the whole day was occupied in crossing a vast plain covered with sheep and cattle, and just after sunset we reached a small *estancia* or sheep-farm. It was occupied by a large family of good-tempered Indians, whose eyes glistened when I offered them a *cesto* of coca which I had with me, in exchange for unlimited supplies of milk and cheese. It was pleasant to see their happiness at the acquisition of this treasure, which was shared by the children and dogs. The place was full of guinea-pigs, which are considered great delicacies. The extreme hunger from which I had suffered since leaving Sandia was here relieved by plenty of milk, cheese, and parched maize. Every night I had wrapped the Russian mats, which enveloped the plants, in warm ponchos, and the tent. The crooked wriggling queñua-branches, which formed the roof of the hut, looked like snakes in the dim light after sunset.

At sunrise on May 21st there was a white frost, and the deep blue sky was without a single cloud. Suddenly an immense flock of flamingos, called *parihuanas*[346] in Quichua, rose in a long column from the margin of the river of Azangaro, which flows through the plain. These birds, with their crimson wings, and rose-coloured necks and bodies, whirring up in a long spiral column, formed one of the most beautiful sights I ever saw.

Crossing a range of rocky hills, we entered a plain, which extended to the banks of a large lake, with the little town of Arapa built along the shore. Dark mountains rise up immediately in the rear. I believe that I am the first English traveller who has ever visited this lake, and M. de Castelnau, who obtained some information respecting it at Puno, says that it is not to be found in any map.[347] Along the shores there were long rows of flamingos, standing like a gigantic regiment, with a few skirmishers thrown out fishing. There were also *huallatas*, ibises, ducks, and a stout-built stunted sort of crane. Journeying on, we began to cross a vast plain which extends for many leagues round the north-west corner of lake Titicaca, and is dotted with walled *estancias* and flocks of sheep. At length we reached the ford over the river of Azangaro, in sight of the little village of Achaya, to the left. The water came above the mules' bellies, and, crossing half a mile of swampy ground, we came to another ford over the river of Pucara. The two rivers, uniting just below Achaya, form the Ramiz, the largest feeder of lake

Titicaca. We continued our way for many hours over the plain, until we reached an Indian's hut long after dark, having been twelve hours in the saddle, at the slow tedious pace of a tired mule. The cargo-mules had played every kind of vicious trick throughout the day, running off in different directions at every opportunity, and constantly trying to roll.

Starting at daybreak on the 22nd, we forded the river of Lampa, crossed the road between Lampa and Puno, passed over a rocky cordillera and a wide plain, and reached the little town of Vilque by four in the afternoon. The place presented a very different appearance from the time when we passed through it in March, on our way to Puno. It was now the time of the great yearly fair, when buyers and sellers from every part of South America flock to the little *sierra* town. This great gathering was first established in the time of the Spaniards, and it is not improbable that the Jesuits, who once possessed the great sheep-farm of Yanarico near Vilque, and who always looked well after the improvement of their property, may have been the great promoters of the fair.

Outside the town there were thousands of mules from Tucuman waiting for Peruvian arrieros to buy them. In the plaza were booths full of every description of Manchester and Birmingham goods; in more retired places were gold-dust and coffee from Caravaya, silver from the mines, bark and chocolate from Bolivia, Germans with glass-ware and woollen knitted work, French modistes, Italians, Quichua and Aymara Indians in their various picturesque costumes—in fact, all nations and tongues. In the plaza, too, there were excellent cafés and dining-rooms, all under canvas; but house-rent was exorbitant, and a lodging was not to be had for love or money. There was much complaint of the injury done to trade by the threatened war with Bolivia, and the edict of President Linares, prohibiting all intercourse with Peru.

I placed the bundles of plants, carefully wrapped round with ponchos, in a barley-field occupied by arrieros, covered over with their warm *aparejos*; but the thermometer was down to 23° Fahr. in the night.

In the afternoon of the 23rd I left Vilque for the sheep-farm of Taya-taya, in company with Dr. Don Camillo Chaves the superintendent. The road was crowded with people coming from Arequipa to the fair at Vilque: native shopkeepers, English merchants coming to arrange for their supplies of wool, and a noisy company of arrieros on their way to buy mules, and armed to the teeth with horse-pistols, old guns, and huge daggers, to defend their money-bags. Many of them were good-looking fellows, the older ones bearing signs of hard drinking.

The sheep-farm of Taya-taya,[348] four leagues from Vilque, is a large range of mud-plastered buildings with thatched roofs, built round a large *patio*, on a bleak plain surrounded by mountains. In the morning a flock of forty llamas were being laden with packs of wool in the patio, at which they were making bitter lamentations. We started

early on May 24th, and encountered a cold gale of wind, blowing in icy squalls over the cordillera. I reached the posthouse of Cuevillas in the night, a distance of 45 miles; got as far as the posthouse of Pati the next day; encountered a tremendous gale of wind on the skirts of the volcano of Arequipa, but descended to the valley of Cangallo on the 26th; and rode into the city of Arequipa, with my plants, on the morning of the 27th of May. Mr. Weir arrived from Crucero on the 29th, having, as I expected, found Martel in that town, whose designs were thus baffled. From Sandia to Arequipa is a distance of nearly 300 miles. No opposition was made to my departure from Arequipa, although the local newspaper had something to say afterwards,[349] and on June 1st the plants were safely deposited by the Wardian cases at the port of Islay.

"John of the Fountain" had provided plenty of soil, and by the 3rd all the plants were established in the Wardian cases by Mr. Weir. But the difficulties of getting the plants out of the country were not entirely ended by my escape from Martel and the *Juntas Municipales* of the interior. The Superintendent of the custom-house of Islay declared it to be illegal to export cascarilla-plants, and refused to allow them to be shipped without an express order from the Minister of Finance and Commerce at Lima. He had probably received intelligence respecting the contents of the cases from Vilque, where all news centres at the time of the fair. This obliged me to go to Lima to obtain the necessary order from Colonel Salcedo, the Minister of Finance, which, after much difficulty, I succeeded in doing, and returned with it to Islay on June 23rd.[350]

Meanwhile, since the plants had been established in the Wardian cases, they had begun to bud and throw out young leaves, which seemed to prove that they had quite recovered from their journey across the arctic climate of the Andes. In the evening of the 23rd the cases were hoisted into a launch, ready to go on board the steamer on the following morning; and during the night attempts were made to bribe the man in charge to bore holes and kill the plants by pouring in boiling water, but without success. On the following day they were safely lodged on board the steamer bound for Panama.

It was impossible not to feel regret that H. M. steamer 'Vixen,' then lying idle at Callao, had not been ordered to take the plants direct across the Pacific to Madras, when a majority would have arrived in perfect order. But this was not to be, and we had to look forward to long voyages, several trans-shipments, and the intense heat of the Red Sea, before this most valuable collection of plants could reach their destination in Southern India.

Yet it could not but be satisfactory to look back upon the extraordinary difficulties we had overcome, the hardships and dangers of the forests, the scarcity of the plants, the bewildering puzzle to find them amidst the dense underwood, the endeavour to stop my journey first at Tambopata and then in Sandia, the rapid flight across unknown parts of the cordillera, and the attempts first to stop and then to destroy the plants at Islay: it was

a source of gratification to look back upon all this, and then to see the great majority of the plants budding and looking healthy in the Wardian cases.

The climate at Islay, during the time that the plants remained there, was as follows, from the 1st to the 24th of June:—

Mean temperature	69° Fahr.
Mean minimum at night	60
Highest temperature observed	73
Lowest	58
Entire range	15

The temperature is almost exactly the same as that of the Tambopata forests in May; but the forests were always exceedingly moist, while Islay is intensely dry. This, however, was unimportant to the plants in their cases.

CHAPTER XVIII.

PRESENT CONDITION AND FUTURE PROSPECTS OF PERU.

Population—Civil wars—Government—Constitution—General Castilla and his ministers—Dr. Vigil—Mariano Paz Soldan—Valleys on the coast—Cotton, wool, and specie—The Amazons—Guano—Finances—Literature—Future prospects.

AFTER a sojourn of a few days at Lima we took a final farewell of the land of the Incas, on June 29th, 1860. As we steamed along the coast, in sight of the emerald-green valleys, surrounded by trackless wastes of sand, and of the glorious cordilleras which towered up behind them, a long train of memories passed in array before us. In this land alone, of all the nations of the earth, did the ideal of a perfect patriarchal form of government become a reality. Here, too, are the scenes of the most romantic episode in modern history, comprised in the career of the Pizarros. The sufferings of the gentle Indians excited the indignation of the Elizabethan chivalry; the fabulous riches extracted from the mines of Peru attracted the adventurous spirit of the buccaneers of a baser age; and the brave struggle for independence led more than one gallant Englishman to shed his blood in the cause of Peruvian liberty.[351] What is now the state of this famous land, and what prospect is there of the glowing hopes expressed in Mr. Canning's well-known speech ever being fulfilled, are questions which cannot fail to arouse some passing interest.

In giving an account of the present condition and future prospects of Peru, the invariable kindness and frank hospitality of its inhabitants impose an obligation to speak with as much leniency and forbearance as the interests of truth will admit. The South American Republics are peopled by races of mixed origin, who are doubtless inferior to Europeans, both mentally and physically; and the unsettled condition of those countries, which inevitably succeeded the struggles for an independence for which the people were unprepared, has continued longer than might justly have been expected. But it appears to be a generally received idea in England, originating from the accounts of travellers unacquainted with the people, and ignorant of their language, that the South Americans are a mongrel degraded race, incapable of improvement, and hopelessly degenerate.[352] So far as my experience extends, and after a careful consideration of the subject, I can see no grounds for resigning the hope that a brighter future is yet in store for the land of the Incas.

It is true that, after a casual and superficial glance at the state of affairs in South America since the expulsion of the Spaniards, the prospect appears sufficiently gloomy. But a more intimate acquaintance with the subject, and especially a knowledge of the

tone of thought amongst the younger men, as expressed in conversation and in their writings, would show that, under the surface, noble aspirations and steady enlightened views prevail, which must eventually yield fruit, and thus justify our hopes for the future. When independence was established in South America, there were two principal causes which led to the civil wars which ensued; namely, the question between a federal or a centralized form of government, and the disputes respecting boundaries. The power attained during the revolution by the armies, and the selfish ambition, treason, and corruption of public men, aggravated these sources of evil to a melancholy extent. But other countries, far greater and nobler than these poor struggling republics, have had to pass through as long and as degrading a crisis in their history. Englishmen must remember the thirty years comprising the reigns of the two last Stuarts with quite as much shame as the great-grandchildren of the present Peruvians will experience when they learn the history of their country for the first forty years after its independence. It is recorded that in a British House of Commons there was but one Andrew Marvel. To my personal knowledge there are now several Andrew Marvels in Chile and Peru. These young and inexperienced countries have had to pass through a fierce ordeal, and, truth to say, they have played their part but indifferently as yet. They indeed require forbearance, but let us not turn from them with disdain and contempt, in the pride of our present grandeur and prosperity. Were treason and corruption and base selfish faction never rife in England's court and parliament?

The fatal mistake of several of the old Spanish colonies was in establishing a federal system of government, in imitation of the United States. This was the case in Mexico, Central America, New Granada, and the Argentine Confederation. No system can possibly be more entirely unsuited to a thinly-peopled mountainous region, without roads, and unprovided with a sufficient number of capable educated men in the distant provinces to undertake the local government. Power necessarily falls into the hands of any cunning adventurer, every little state becomes a focus for revolution, and an endless succession of civil wars are the result. Such, in fact, has been the fate of those republics where federation has been established. Pernicious as centralization always is when carried too far in old and densely-peopled countries, it is an absolute necessity in young states, with a small population thinly scattered over a vast extent of country. The distant inaccessible districts do not possess the materials for self-government within themselves, and necessarily depend for their prosperity and advancement on the capital.

Peru has only once been subjected to the federal experiment, and she has not suffered so much from internal dissensions as the unfortunate countries above mentioned. She holds a central position amongst the South American republics, not so cruelly torn by anarchy as Mexico on the one hand, and not enjoying so good and settled a government as Chile on the other. Her people too are perhaps inferior in capacity and mental endowments to the Chilians and the natives of New Granada, but infinitely superior to those of Central America and Mexico. She may, therefore, be taken as an average example of these half

Spanish, half Indian states; and as such I will proceed to give some account of her people, her government, and her material resources.

The population of Peru, by the latest accounts, was 1,880,000 souls: the whole of the labouring classes in the interior being pure Indians; the artizans and shopkeeping classes in the towns partly Indians and partly half-castes or mestizos; the lower orders on the coast being negros, or zambos, a caste between negros and Indians, with some imported Chinese; and the upper classes being chiefly of Spanish descent with a slight dash of Indian blood, many nearly or quite half-castes, not a few pure Indian, and an exceedingly small proportion of pure Spanish descent.[353] The men of Indian extraction display perhaps more energy and equal ability with their fellow-countrymen of pure Spanish origin; and many Indians are wealthy enterprising men, while others have held the highest offices in the state. The Peruvians are intelligent and quick of apprehension, exceedingly hospitable and kind-hearted, and remarkably humane and forgiving, as a rule, in the conduct of their civil wars; but they are apt to be fickle and volatile, incapable of any long-sustained effort, and inclined to indolence. Corruption, bribery, treason, and pusillanimity are but too common; but may not these be the vices engendered by civil strife and periods of anarchy, rather than the normal characteristics of the people? With the exception of the negro races on the coast, there are few people among whom crime is more uncommon.

The causes of the civil and foreign wars which have retarded the progress of Peru since her independence may be explained in a very few sentences.

The first of these has arisen from disputes with her neighbours respecting boundaries. On her southern frontier the ambitious policy of Bolivar created a small republic, from no reason or motive that was apparent, beyond the childish vanity of having a country called after his name. This country was to all intents and purposes a part of Peru. Her people, her languages, her traditions and feelings were the same, and, until the latter part of the last century, she had formed a part of the Peruvian viceroyalty. No good end was attained by this division; while disputes respecting a doubtful unsurveyed boundary, jealousies and misunderstandings arising from all imported goods from Europe having to be landed at the Peruvian port of Arica, and conveyed to Bolivia across Peruvian territory, has created a hostile feeling, embittered year by year, between people who should have lived as brothers under a single government. On her northern frontier Peru has the little republic of Ecuador, until 1830 a portion of Colombia; which possesses the only good port, with the exception of Callao, on the western coast of South America, that of Guayaquil. This port has always been coveted by Peru; and the question of the frontier was further confused by the civil jurisdiction in Peru and Quito, during Spanish times, having been divided by one line, and the ecclesiastical by another. The generally recognised rule for deciding the frontiers

between the South American Republics is the *uti possidetis*, as regards the former colonial jurisdictions, at the time of the war of independence.

These frontier disputes, carried on with feelings embittered by former jealousies, led to a war between Colombia and Peru in 1828,[354] in which the latter republic was worsted; and a campaign, ending in a treaty, between Peru and Bolivia at the same time.

The second and more disastrous cause for civil dissensions was the question between a federal and a centralized form of republican government. Peru enjoyed a period of peace between the war with Colombia in 1828 and the year 1834; but between the latter period and the year 1844 the unfortunate country was subject to a constant series of civil wars and insurrections. The ten years between 1834 and 1844 was Peru's most miserable time. Her public men were corrupt, pusillanimous, and selfishly ambitious; she was given up to be torn and distracted by wretched military adventurers; and the marches of armies, with their system of forced recruiting, banished all attempts at advancement or improvement from the country. Yet even during this dark interval there was a space of two years, when General Santa Cruz established his dream of a federal republic under the name of the Peru-Bolivian Confederation, during which the land enjoyed peace and some signs of revived prosperity. The able and vigorous administration of Santa Cruz, whose mother was an Indian chieftainess, was the one bright spot in this dreary waste of anarchy.

For the following ten years Peru enjoyed a period of peace, under the rule of General Don Ramon Castilla, an old Indian of Tarapaca, for the first six years, and afterwards of General Echenique. During this period the country advanced rapidly in material prosperity, but in 1854 it was again convulsed by a revolution, caused by the general discontent of the people at the gross malversations and unblushing robbery of Echenique's Government. Castilla placed himself at the head of this movement, and, with the aid of a large army, has retained his power up to the present day. The insurrection at Arequipa, and mutiny in the fleet, in 1857-58, were purely local, and did not affect the general tranquillity of the country.

Towards the close of Peru's ten years of convulsion, a constitution was adopted, establishing a strictly centralising form of government, in 1839, in which immense power was placed in the hands of the executive. But during the ten years of peace which followed the election of Castilla in 1844, men's minds were strongly influenced by European travel and by more extended reading, extreme liberal views were very generally adopted, and the old constitution was felt to be out of date. In 1856, therefore, a new constitution was promulgated by a national assembly summoned for the purpose by General Castilla, in which abstract ideas of what is just and right were unhesitatingly and heedlessly adopted; and a strong tendency to federalism and local self-government was displayed.

By a stroke of the pen the capitation-tax paid by the Indians, the principal source of revenue in ordinary times, the slavery of negros on the coast, and all capital punishments were entirely abolished. There would have been some nobleness in the abolition of slavery, and the grant of 1,780,000 dollars as compensation, as well as a display of liberal sentiment, if it had in any way increased the burdens of the people, but this was not the case. For the same reason the discontinuance of the tribute paid by the Indians was a mere act of recklessness. In this constitution there were two legislative chambers, a Senate and a House of Representatives; but half the representatives were chosen by lot to form a Senate, so that one chamber was a mere counterpart of the other. The most remarkable clauses, however, were those in which measures leading to the federal form of government, a plagiarism of the disastrous system of the United States, were adopted. Peru continued to be divided into Departments governed by Prefects appointed by the President; but it was now enacted that in the capital of each Department there should be a sort of state legislature called a *Junta Departmental*, the members being elected by the people, and empowered to deliberate and legislate for the good of the Department. This measure was but a commencement of that fatal system which had convulsed some of the other republics; and its tendency was so apparent that Castilla was accused of intending to divide Peru into a dozen petty states, and to rule as a Dictator, by fomenting dissensions among them.[355] A wiser and more useful measure was the establishment of what are called *Juntas Municipales* in the towns and unions of villages, composed of the principal residents, who are intrusted with the supervision and promotion of all local interests and improvements.

In November 1860 this constitution was reformed, improvements were introduced, and some of its more absurd and injurious provisions were repealed. Capital punishment for the crime of murder was again enacted. The Congress was to meet every two years on the 28th of July; a third of their number to be renewed every two years; and, during the recess, a permanent committee of the Congress, consisting of seven senators and eight deputies, to be elected at the end of each session, was to watch the execution of acts passed by the Congress, and to exercise its functions. A great improvement was also adopted in the constitution of the Senate. The members of that body are to be elected by the Departments, each one electing a certain number according to the number of its provinces, and the qualification of a senator is raised to 1000 dollars a-year. Thus there is now an intelligible difference between the two chambers, and, in the formation of the Senate, one of the few good points of the constitution of the United States has been wisely adopted. The executive power is in the hands of a President and two Vice-Presidents elected for four years, and a council of ministers. Finally the mischievous *Juntas Departmentales*, which I believe had never been allowed to meet, were abolished, while the municipal institutions of the constitution of 1856, which could only be productive of good, remained in full force.

Such is the present form of government in Peru, perhaps as good a one as the country is fit for, and capable, in firm and honest hands, of meeting all the present requirements of the people; but it is of more importance to know in whose hands the government of the country is placed, and what manner of men are intrusted with the destinies of a country so rich in memories of the past, as well as in material resources; a young republic still bleeding at every pore from a series of civil wars, yet with a growing desire to struggle up, through shame and misfortune, to a respectable place among the nations. I will give a few hasty sketches of the men who formed the executive power during my stay at Lima in 1860.

General Ramon Castilla, the President, is a native of Tarapaca in the extreme south of Peru, and must now be close upon seventy years of age. He is the son of Pedro Castilla, who worked the refuse silver-ores of the mines of El Carmen,[356] and young Ramon acted as his father's *leñatero*, or woodcutter. He, afterwards, entered the Spanish army, and on the arrival of the patriot forces from Chile in 1821 he joined their cause, and attained the rank of colonel. After the independence he was appointed Sub-prefect of his native province of Tarapaca, in 1826; and he was Prefect of Puno from 1834 to 1836; but he was mixed up in all the civil wars, and, after a victory gained by him in 1844, he was elected President of the Republic. Castilla is a small spare man, with an iron constitution, and great powers of endurance. His bright fierce little eyes, with overhanging brows, stiff bristly moustaches, and projecting under lip, give his countenance a truculent expression, which is not improved by a leathery dried-up complexion; but he has a look of resolution and an air of command which is almost dignified. This remarkable man is an excellent soldier, brave as a lion, prompt in action, and beloved by his men. Uneducated and illiterate, his political successes and management of parties almost amount to genius, while his victories have never been stained by cruelty, and his antagonists have seldom been proscribed for any length of time, generally pardoned at once, and often raised by him to posts of importance in the service of the Republic. His firm and vigorous grasp of power has secured for Peru long periods of peace; faction has been kept under, while an incalculable blessing has thus been conferred on the country; and probably no other man had the ability and the nerve to effect this. But Castilla, though a necessity, has been a necessary evil. His want of education renders him useless as a statesman. He has generally shown himself indifferent to all public works, and to measures for the moral or material benefit of the country, while he insists on keeping up an enormous standing army, and on spending untold sums on a costly navy, thus squandering the public money, and continuing a pernicious and ruinous system. The brave old man has been a necessity. He alone has been able to keep the peace, and give time to the Peruvians slowly to develop the resources of their country; and through this period of tranquillity, when he shall have passed away, interests and influences may have insensibly risen up, which will prevent

the recurrence of such periods of anarchy as preceded Castilla's first accession to power.

Juan Manuel del Mar, the first Vice-President, a tall, sallow, earnest-looking man, is a native of Cuzco, the old capital of the Incas. He has held office for some years, and has more than once been in supreme command during the absence of Castilla. This statesman was called to the bar in 1830, and has led an active public life as deputy to Congress, judge, or minister ever since. He is thoroughly honest, possessed of enlightened views and some ability, very popular, and universally and deservedly respected.

The second Vice-President, elected under the provisions of the reformed constitution of 1860, is General Pezet, the son of a physician of French extraction, who died in Callao Castle when it was held by the Spaniards, and stood a long siege. General Pezet, a native of Lima, joined the patriot ranks when they landed in Peru in 1821, then only eleven years of age; and was at once sent on active service. Thus he was present at the battles of Junin and Ayacucho, which destroyed the Spanish power, and was mixed up in the subsequent civil wars.

Castilla's ministers, at the time of my visit, were far from representing the most able and distinguished class of Peruvians. Colonel Salcedo, the Minister of Finance, a native of Lampa, was born in 1801. He was one of the few members of Congress who, in 1824, firmly opposed and defeated the ambitious designs of Bolivar; and he has since almost constantly served as sub-prefect or prefect, or as a member of Congress. Another minister was Don José Fabio Melgar, a brother of the famous poet of Arequipa, whose melancholy death I have already mentioned. He has served as chief clerk in one or other of the public offices since 1833, is an amiable man, well read, and intelligent, but with only moderate abilities, and no originality or force of will. The minister of Foreign Affairs was Don Miguel del Carpio, a veteran statesman, born in 1795, and who, having joined the patriots and been taken prisoner by the Spaniards in 1822, was long kept in prison, and heavily chained. Since the independence he has held important offices both in Bolivia and Peru.

But old Castilla requires obedient clerks around him, not independent ministers, and the more able and active-minded Peruvians are not to be found filling high political posts. The best specimens of the natives of Peru are either to be met with leading unobtrusive literary lives, and preparing for better times; or on their estates actively and energetically developing the resources of their country. Such men are Mariategui, Felipe Pardo, Vigil, Paz Soldan, and Elias, whose patriotism and great ability would do honour to any country.

Dr. Vigil is one of Peru's most distinguished sons. In early life he was an active and eloquent member of Congress; subsequently he was engaged on one of the most learned, as well as the most liberal works that a Roman Catholic clergyman has ever ventured to

publish on the Papacy; and now in his old age he continues to advocate, in his forcible writings, every cause and every measure which is intended to advance religious freedom, or the moral well-being of his countrymen. Dr. Vigil fears that liberal views on religious subjects, such as toleration, the marriage of the clergy, and independence of Rome, cannot be expected to make any rapid progress at present, but he is confident that a future generation will appreciate his works, and introduce the measures which he advocates. One of his strongest convictions is that priests will never lead virtuous lives until they are humanized by family ties: and that, while now they live for the Church—that is for themselves and their order—they ought to live for their flocks.

While the learned and amiable Vigil represents the literary men of Peru, Mariano Paz Soldan is one of the best specimens of the men of action. His benevolent mind was shocked at the wretched condition of the prisons in Peru, and he has displayed an amount of energy and ability in endeavouring to remedy this evil which goes far to vindicate the Peruvian character from the charge of indolence and procrastination. In 1853 Paz Soldan published a very able and detailed report on the prisons of the United States; and in 1856, by dint of unceasing representations, he obtained the necessary grant from the Government for the erection of a penitentiary on the most improved principle at Lima. The work was at once commenced with vigour. The foundations, basement, and first story are built of a very hard porphyritic stone, brought from the hills about two miles from Lima, where a quarry was opened for the first time by Paz Soldan, with a tramroad direct to the works. The entrance is by a flight of four steps, cut out of a single block of this porphyritic rock. The second story is of brick, and all the iron for gratings, doors, bolts, and roofing came out ready made from England. The wards for men, women, and children are separated, each with its large well-ventilated workroom, exercising yard, and cells; and everything is arranged on the best English and American models. It will hold 52 women, 52 boys, and 208 men. This great public work will be a credit to the country, and a lasting monument of the energy and perseverance of its projector, who trusts that it will be but the first of a series of such penitentiaries in different parts of the country. Don Mariano Paz Soldan is also engaged in organizing a general topographical survey of Peru.

There are many landed proprietors and others, of Paz Soldan's stamp, who have availed themselves of the period of tranquillity since 1844, interrupted only by one year of revolution, to improve their estates, and thus add to their country's wealth, especially in the valleys on the coast. The long slip of land between the Andes and the Pacific Ocean enjoys an equable climate, rain and heavy storms are nearly unknown, and refreshing dews descend during the night. The greater part of this region consists of sandy desert, traversed by ridges of rocky barren hills; but wherever a stream, descending from the Andes, is of sufficient volume to reach the ocean, a rich and fertile valley borders its banks. These valleys, of greater or less extent, and at various intervals, break the monotony of the desert from the bay of Guayaquil to the river Loa, which separates Peru

from Bolivia. They are admirably adapted for the cultivation of cotton, the vine, the olive, and sugar-cane.

Immense wealth is already derived from these valleys, and, with judicious outlay for obtaining more regular supplies of water, their capabilities might be multiplied indefinitely. The valley of Cañete, south of Lima, which is in the hands of six enterprising proprietors, is covered with sugar-cane plantations. In 1860 it yielded sugar worth 1,000,000 dollars, all raised by Chinese and free negro labour. Further south, the valleys of Pisco and Yca, thanks chiefly to Don Domingo Elias and his sons, yield 70,000 *botijas* of a spirit called pisco, 10,000 barrels of excellent wine, 800,000 lbs. of cotton, and 40,000 lbs. of cochineal. Still further south there are many valleys which render their owners wealthy by the produce of cane-fields and vineyards, in the departments of Moquegua and Arequipa; and in the valley of Tambo, near Arequipa, there are 5000 olive-trees and seven mills.

Now that the question of cotton-supply is attracting so large a share of attention in England, it is gratifying to be able to state that landed proprietors on the coast of Peru have seriously turned their attention to the subject, and that in 1860 the cultivation of cotton was becoming a favourite speculation. The soil and climate of these coast valleys are admirably adapted for its growth, and, though the quantity that could be drawn from them would be insignificant when compared with the vast demands of Manchester, yet the quality is good, and they will supply one out of many sources which may hereafter render us partially independent of the Confederate States. The estates of Don Domingo Elias and others, in the valleys of Yca, Palpa, San Xavier, and Nasca, yield 800,000 lbs. of excellent cotton. I visited these cotton estates in 1853, and found that the cotton was carefully picked, and packed by screw presses. A great deal of cotton is also shipped from the port of Payta, which sells in Liverpool at 8*d.* to 9½*d.* the lb.; and in the valley of Lambayeque,[357] between Payta and Lima, cotton cultivation has lately been undertaken on a very large scale. In 1860, in the four districts of Talambo, Cayalti, Collus, and Calupe, there were already 600,000 plants in the ground, and in neighbouring estates extensive tracts of land had been prepared for cotton by the house of Zaracondegui and others. At Talambo, in the valley of Pacasmayo, there are many Biscayan families, numbering in all 176 souls, who are exclusively engaged in cotton cultivation; and the yield in that district in the first year was 800,000 lbs. In the province of Chiclayo 700,000 plants were put in the ground during 1860, and land was being prepared for the growth of cotton crops to a much larger extent. These cotton-growing provinces of Lambayeque, Chiclayo, and Truxillo are fertile and well watered; storms of rain are unknown, and they enjoy an equable climate with a mean temperature between 70° and 84° Fahr. It has been calculated that, after leaving a fifth of the available land for crops to supply provisions for the inhabitants, as many as 140,000 *fanegadas*[358] might be brought under cotton cultivation in these provinces alone. Allowing four feet for each plant, and that each plant yields four pounds a year, this

extent of land would produce 580,000,000 lbs. of cotton annually, worth twelve dollars the cwt. at the port of shipment, or 69,600,000 dollars. Deducting 22,400,000 for expenses, this would leave 47,200,000 dollars profit. But these provinces only contain a small fraction of the fertile coast valleys of Peru; and it is clear that, if the speculations of 1860 yield a reasonably profitable return, the cultivation of cotton may, in all probability, be undertaken over a vast area, and render Peru an important source of supply for Manchester.[359]

The lofty table-lands of the cordillera of the Andes produce sufficient maize, wheat, and sugar for home consumption; but their chief exportable wealth is to be found in the vast flocks of sheep and alpacas which find pasture on those grassy uplands, and in the veins and washings of silver and gold. About 400,000*l.* worth of wool is annually exported, of which 5,017,100 lbs., valued at 287,339*l.*, were embarked from the port of Islay in 1859, and 4,214,000 lbs. in 1860. The export of specie amounted to about 200,000*l.* in 1859, of which 34,705*l.* were exported from Islay, and 32,000*l.* from Arica. But of this a portion is in coined money and *chafalonia*, or old plate.

Besides the raising of the various valuable products suitable to the coast valleys and the *sierra*, the vast forests to the eastward of the Andes, and the great fluvial highways which flow through them to the Atlantic, offer an inexhaustible field for Peruvian enterprise. The incredible resources of this portion of Peru are only now beginning to be fully appreciated, though ten, and even twenty years ago, there were evident symptoms of the first early pulsations of life and commerce on the mighty river Amazons and its tributaries. Petty traders, the pioneers of a stirring future, were then busy, each in his little traffic; canoes laden with hammocks, hats, wax, sarsaparilla, copaiba, and other products of the forest, found their way to Para at the mouth of the Amazons, and returned with European manufactured goods.

But of late years an immense stride in advance has been taken; and in 1857 a Brazilian company was working eight steamers on the Amazons and its tributaries, conveying passengers, and bearing up and down a ceaseless ebb and flow of commerce. Measures were adopted in 1853 to connect the Brazilian line of steamers with a Peruvian line navigating the upper waters, and two small steam-vessels were sent out from New York for the purpose, called the "Tirado" and "Huallaga." The revolution of 1854 temporarily put a stop to these efforts, and the two steamers were left to rot at Nauta, 2300 miles up the Amazons. Latterly, however, steps have again been taken to supply the Peruvian tributaries of the Amazons with steam navigation, and thereby to encourage settlement, attract commerce, and thus develop the incalculable wealth of Peru's Amazonian provinces.

In October 1858 a fluvial convention was signed between Brazil and Peru, establishing the free navigation of the Amazons, under certain restrictions; and in February 1860 the Brazilian steamer 'Tabatinga' arrived at Laguna on the Peruvian river Huallaga,

upwards of 3000 miles from the mouth of the Amazons. Meanwhile the Peruvian Government have ordered steamers to be constructed to work on the upper waters of the Amazons, in conjunction with the Brazilian line; and roads are to be made connecting inland towns with the nearest navigable points on the tributaries of the Amazons. In June 1860 a party of sixty men left the town of Huanuco to explore the wide forest-covered plains known as the "Pampas del Sacramento" to the eastward; and in July a road had already been commenced, which is to connect Huanuco with a navigable part of the river Ucayali, a distance of 150 miles. A small colony of Germans has been established on the river Pozuzu. Other measures of a similar nature are in contemplation, and it is impossible to estimate the rapid and certain increase of wealth which will accrue to this hitherto neglected region, when steam communication has thus brought one of the richest regions in the world within reach of a market. Para, at the mouth of the Amazons, already exceeds, in the number of its staple commodities of export, all indigenous to the regions of which it forms the outlet, almost any other port on the surface of the globe. My space will not allow me to dilate further on this most interesting subject; but it is assuredly one which well deserves the attention of commercial men in England.

The most remarkable source of Peruvian wealth, and one which has caused effects on her financial system which are perhaps unique in the history of any country, is the guano on the desert islands off the coast. When the South American Republics were thrown open to the trade of Europe, the value of guano as a manure was soon discovered, the demand rapidly increased, and the Peruvian Government were not long in availing themselves of this, as they believed, inexhaustible source of riches.[360] The three Chincha islands, in the bay of Pisco, contained a total of 12,376,100 tons of guano in 1853, and, as since that time 2,837,365 tons have been exported up to 1860, there were 9,538,735 tons remaining in 1861.[361] In 1860 as many as 433 vessels, with a tonnage of 348,554, loaded at the Chincha islands; so that, at the above rate, the guano will last for twenty-three years, until 1883. The guano monopoly brings in a revenue to the State of 14,850,000 dollars.

In Peru even the arid deserts are the sources of enormous wealth; for while the desolate Chinchas pour millions into the treasury, the pampa of Tamarugal, in the Tarapaca province, contributes its nitrate of soda (*salitre*) and borate of lime to swell the riches of this favoured land. It is calculated that the nitrate of soda grounds in this district cover fifty square leagues, and, allowing one hundred pounds weight of nitrate for each square yard, this will give 63,000,000 tons, which, at the present rate of consumption, will last for 1393 years.[362] In 1860 the export of nitrate of soda from the port of Iquique amounted to 1,370,248 cwts., and a good deal of borax is also exported, though its shipment is prohibited by the Government.

The extensive use of mineral substances, such as guano and nitrate of soda, as a top-dressing for corn-crops, is a discovery of modern times, and these manures were not

generally appreciated in England until a period between 1824 and 1829. I believe that farmers consider guano and nitrate of soda to be about equally efficacious as a top-dressing for corn; and it is now a matter of pressing interest to the agricultural community in England to reduce their prices, which are as high as twelve and sixteen pounds a ton respectively. But, with this view, a careful search for deposits of guano in other parts of the world has only led to the discovery of those at Ichaboe, on the coast of Africa, in 1843, and of those on the Arabian Kooria Mooria islands more recently. The deposit at Ichaboe was all carried off by the end of 1845, while that on Jibleea, one of the Kooria Moorias, is still being worked; but it is very inferior to the guano of the Peruvian islands.[363]

On the whole these attempts to find other deposits of guano, which would tend to bring down the price in England, have failed of success; and the Peruvians may consider themselves secure of their strange source of revenue for some twenty years to come. And a stranger means of defraying nearly the whole expenditure of the state was never before heard of. In 1859 the disbursements amounted to 20,387,756 dollars, of which sum three-fourths were raised by shovelling heaps of dirt off a desolate island on the coast!

A prudent Government would have looked upon the guano monopoly as an extraordinary item in the receipts, and would have reserved it for paying off the internal and foreign debt, for public works, and improvements; but the heads of the Peruvians appear to have been turned by this wonderful increase of their revenue, and they have squandered it with ruinous and dishonest recklessness. It is true that the interest of the foreign debt has been paid,[364] but otherwise the large receipts have either been embezzled, as in General Echenique's time, or spent on immense and unnecessary armaments, and in jobbing salaries and pensions. Thousands of families now live on the public money, and, when the guano receipts fail, the ruin and suffering will be severe and widely spread. On the strength of the guano monopoly almost all the taxes have been abolished, the tribute of the Indians amongst them, and the revenue is composed mainly of three items—guano, customs, and stamps. A biennial budget, containing the receipts and disbursements, is laid before Congress every session. I have these budgets before me for several years back; but that for 1859 will suffice to show the extraordinary nature of the revenue, and the still more extraordinary way in which it is spent:—

Receipts.	Dollars.	*Disbursements.*	Dollars.
Guano	15,875,352	Pay, &c., to members of Congress	211,084
Customs, &c.	5,079,439	Army and navy, with pensions	9,746,432
Surplus from 1858	938,389	Civil expenses, with pensions	2,129,904

	Payments to ecclesiastics	63,296
	Public works	718,124
	Education and charitable institutions	332,471
	Police	92,807
	Compensation for slaves and internal debt	1,576,004
	Redemption of Bonds	3,218,700
	Miscellaneous	107,146
	Interest of all kinds	2,191,777
		20,387,745
	Surplus	1,505,435
21,893,180		21,893,180

The foreign debt is 24,205,400 dollars, and the internal debt and compensation for slaves amount to a still larger sum. But the great drag upon the public treasury is the enormous army of 15,000 men for a population under two million, with upwards of 2000 officers, those who are unattached being still retained on full pay. This will give some idea of the number of families who are living in luxury and idleness on the public money, and of the distress that will follow the sudden stoppage of their incomes, which is inevitable when the guano comes to an end. It will be an embarrassing and difficult question for some future Government to decide upon the proper measures for the disposal of an unwieldy army and a crowd of hungry beggared officers. The best suggestion on this subject has come from the late General Miller, who, when governing Cuzco in 1836, proposed to establish military colonies in the forests to the eastward of the Andes, and thus convert a mischievous and dangerous tool for treason and faction into a means of enriching the country.

The administration of justice in Peru, though the laws are excellent, and have been codified and ably edited, is so corrupt that it is better to pass over the subject with a hope that things may be better in a future generation; and the police administration, especially round Lima, is disgraceful.

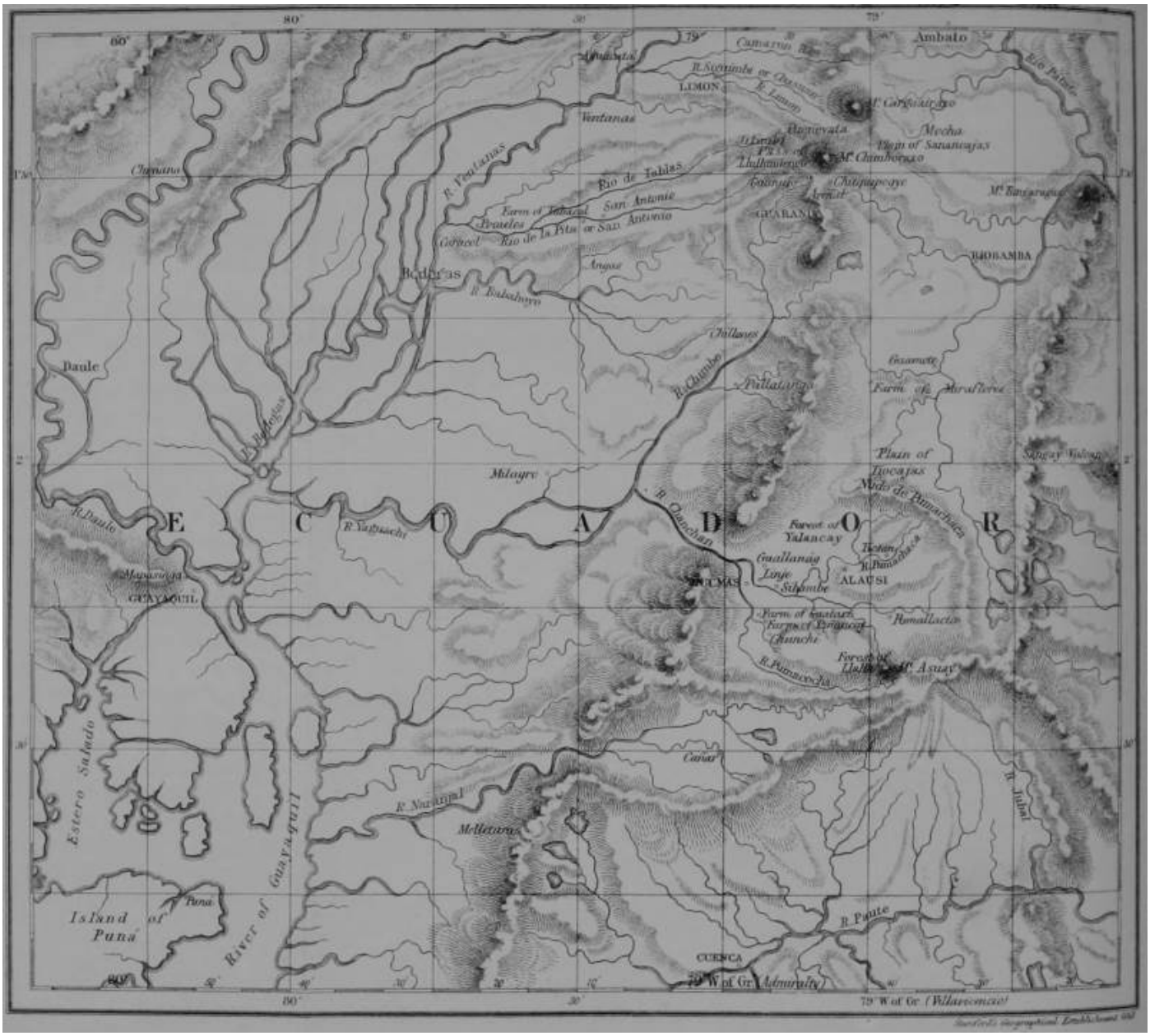
Much indeed will be required, and much I trust is to be hoped, from the rising generation of young men who are now about to enter upon public life. Many of them have been educated in Europe, a large proportion are well-informed, polished by travel and extensive reading, and ardently desirous of distinguishing themselves in the service of the State. In literature they have already displayed considerable industry and ability. The 'Revista de Lima,' a bi-monthly periodical, contains archæological, biographical, historical, and financial articles and reviews, generally very ably written, in an enlightened and liberal spirit, and by men who evidently take an earnest view of life. The contributors, among whom are the Señores Lavalle, Ulloa, Pardo, Flores, Masias, and the painter Laso, are all young men with a career before them. It is a good sign, too,

that effective steps have been taken to edit and reprint historical materials which have long remained in manuscript, or in scarce old editions. Thus Don Manuel A. Fuentes has recently brought out six most interesting volumes containing reports of the administrations of several of the Spanish viceroys of Peru,[365] and a new edition of the 'Mercurio Peruano.' His 'Estadistica de Lima' is also a work which displays considerable merit: and Don Sebastian Lorente's well-known learning, and habit of careful research, promise that his history of Peru, now on the point of being published in Paris, will be a work of great value.

This hasty glance at the present state of Peru, as regards its government, material resources, and literature, will, I trust, have shown that the people of these South American states are not altogether the hopelessly degraded race that they are often represented; and that there are grounds for believing that there is yet a happier future in store for them. For, be it remembered, that Peru is far from being the best specimen of these republics, and that the Chilians have displayed tenfold the ability, both in governing, in commercial and agricultural pursuits, and in literature. I think there can be no doubt that a hasty conclusion respecting the South American races, founded on their history since the independence, is likely to be erroneous and unfair; and that, under more favourable circumstances, they are in every way capable of better things.

I cannot better conclude this chapter than by quoting the words of that noble old warrior General Miller, written only a few months before his death, in November 1861. This most excellent of men fought all the battles of independence from 1817 to 1824; he was covered with wounds and riddled with bullets[366] while striving for South American freedom; he had watched with sorrowful attention the subsequent anarchy and civil wars, and his words carry great weight with them. It will be seen that he does not despond, but looks forward with hope to the future.

He says, "South America, with good reason, must feel for ever proud of Camilo Henriquez, Vigil, and Mariategui, Olmedo and Felipe Pardo, San Martin and O'Higgins, and many others of her illustrious sons. And what may not be expected from the rising and future generations, now that there are such universities as that of Santiago de Chile, and such men as Bello to direct and foster them! Who can be blind to the genius and great natural abilities of the Peruvian youth, now shooting forth, notwithstanding the great disadvantages under which Peru at present labours, with regard to the state of her colleges? With her immense resources, a good government, and tranquillity, what may not be expected! But every nation has its beginning, an inevitable and perhaps necessarily rough ordeal to undergo, and South America must not expect to make a leap that no other country has been able to do."


Ambato
LIMON
Ventanas
Chimbo
Baulé
Milagro
GUAYAQUIL
Estero Salado
River of Guayaquil
Island of Puna
Puna
Mellaro
Canar
CUENCA
ALAUSI
GUARANDA
RIOBAMBA
Mt. Chimborazo
Mt. Carguairazo
Mt. Tunguragua
Mt. Assuay
Sangay Volcan
Plain of Tiocajas
Forest of Yalancay
Farm of Huaflores
Farm of Tomabela
Farm of Chunchi
Farm of Lanzoco
Rio de Yahuachi
R. Chanchan
R. Chimbo
R. Naranjal
R. Paute
R. Yaguachi
R. Baulé
R. Pumacunga
R. Jubal
Rio de la Pita or San Antonio
Rio de Yahuachi
Rio Palmar
Rio de Yahuachi
Rio de Yahuachi
Rio de Yahuachi

CHAPTER XIX.

Mr. Spruce's expedition to procure plants and seeds of the "red bark" or *C. succirubra*—Mr. Pritchett in the Huanuco region, and the "grey barks"—Mr. Cross's proceedings at Loxa, and collection of seeds of *C. Condaminea*.

In a previous chapter I have given an account of the arrangements which I made for procuring the various species of Chinchonæ in districts other than that of the Calisaya, and it now remains for me to record the labours of those whom I employed on this service, and the successful results with which those labours were rewarded. And first, both in importance and success, stands the expedition of Mr. Spruce, to collect the seeds and plants of the "red-bark" tree or *C. succirubra*, of whose services it would be impossible to speak too highly. I may mention, at starting, that he received my first letter, requesting him to undertake the work, on July 2nd, 1859, and such was his zeal that on the 22nd of the same month he was on his way to the chinchona forests, at his own expense, to ascertain the best locality for collecting the plants and seeds.

The species of chinchona, known as the "red-bark" tree, yields a larger per-centage of febrifugal alkaloid than any other, and must therefore be considered as the most important.[367] Its native forests are on the western slopes of the famous mountain of Chimborazo, in the Republic of Ecuador, and for a great many years it has not been found beyond 2° 36′ S. lat., but Mr. Spruce thinks it probable that in former times the tree grew all along the roots of the Andes of Cuenca and Loxa to the limits of the Peruvian desert in 5° S. To the north it scarcely passes the latitude of 1° S.; and these precious trees are thus confined within a very narrow latitudinal zone.[368] Within the ascertained limits of the true "red-bark" tree, it exists in all the valleys of the Andes which debouch on the plain of Guayaquil; but great havoc has been made amongst the trees of late years by the bark-collectors. In the valleys of Alausi, Pallatanga, and Chillanes (see map) all the large trees have already been cut down. At the bases of the ridges of Angas and San Antonio, the localities originally mentioned by Pavon, and where "red-bark" trees once grew in abundance, the same destructive system has been adopted; and now the "red-bark" grounds are confined to the ravine of the river Chasuan, and its tributaries, which rise on the northern slopes of Chimborazo, and fall into the river of Guayaquil.

On the 22nd of July 1859 Mr. Spruce set out from the pleasant town of Ambato, in the Quitenian Andes, where he was then residing, and, passing through Alausi, arrived at the banks of the river Chanchan, and established himself at a place called Lucmas, which is conveniently near the "red-bark" chinchona forests. Lucmas is a sugar-cane farm, between 5000 and 6000 feet above the sea; there are forest-trees in the valleys

and on the hills, while the steep slopes are often covered with scrub and grass. From Lucmas Mr. Spruce went to the forests on the banks of the river Pumachaca, which rises in the mountain of Asuay, and falls into the Chanchan, at an elevation of 4000 feet. One circumstance, among many, will give an idea of the difficulties which he had to encounter. On reaching the Pumachaca he found that the ford had been destroyed by the falling of a cliff, and that in its place there was a deep whirlpool; so, with the driftwood along the banks, a bridge had to be made where the river was narrowed between two rocks, by which his party crossed with the baggage. Then, after a long search, he found a place where the horses could swim across, and, by rolling down masses of earth and stones, a way was made for them to ascend on the other side. Once across, a hut was made among vegetable-ivory palms, thatched with the palm-fronds, and Mr. Spruce commenced the examination of the forest.

After a long search, during which he passed several felled trunks of chinchona-trees, he at length came upon a root-shoot about twenty feet high. It is very rare to find these root-shoots, because the bark is stripped from the roots as well as from the trunk. Mr. Spruce, from his observations in the Pumachaca forest, came to the conclusion that the "red-bark" trees grow best on stony declivities, where there is, however, a good depth of humus, at an elevation of from 3000 to 5000 feet above the sea. The temperature was very like that of a summer day in London, but with cold mists towards evening, and from January to May unceasing rain. He found the chinchona-trees, in this part of the country, almost entirely extirpated, and, after a short stay at Lucmas, he proceeded to examine the region of the "hill barks" or *cascarillas serranas*, which is at an elevation of 8500 to 9000 feet, on both sides of the river Chanchan. In the forest of Llalla, at the foot of the mountain of Asuay, he found two kinds called by the natives *cuchi-cara* (pig-skin) and *pata de gallinazo*;[369] and on a stony hill-side there were twenty large trees of the former, from 40 to 50 feet high.

By this excursion in the summer of 1859 Mr. Spruce ascertained the districts where he should not go to, a very important point; and he finally determined to carry on his collecting operations, in the season of 1860, at a place called Limon, at the junction of a stream of that name with the river Chasuan, which falls into the river of Ventanas at a place called Aguacatal. (See map.) The forests are all private property, and, after much negotiation with the owners, Señor Cordovez of Ambato, and Dr. Neyra of Guaranda, an agreement was made by which, on payment of 400 dollars, Mr. Spruce was allowed to take as many seeds and plants as he liked, on condition that he did not touch the bark.

Mr. Spruce had made arrangements for Dr. Taylor of Riobamba to proceed to Loxa, and collect seeds of the *C. Condaminea* species; but a severe rheumatic and nervous attack, almost amounting to paralysis, induced him to resign the duty of collecting the "red bark" to Dr. Taylor, and it was only at the last moment that he was strong enough to undertake the journey in company with his friend. During the whole time that Mr. Spruce

was at work he was suffering severely from illness; the benefit derived from the milder climate of the forests was neutralized by the fogs and damp; and, to use his own words, "although upheld by a determination to execute to the best of my ability the task I had undertaken, I was but too often in that state of prostration when to lie down quietly and die would have seemed a relief." Leaving the town of Ambato on the 11th of June, Mr. Spruce and Dr. Taylor reached Guaranda on the 13th, and continued their journey towards the forests on the 17th. At a very little below 4000 feet above the sea they reached the small farms at Limon. Their abode stood on a narrow ridge sloping gradually to the river Chasuan. It was merely a long low shed, two-thirds of which was occupied by the rude machinery of a sugar-cane mill; the remaining third had an upper story with a flooring of bamboo-planks, half of it open at the sides, and the other half with a bamboo wall about six feet high, not coming up to the roof in any part of it. This was their dormitory, and it was reached by a ladder, merely a trunk of a tree with rude notches for steps. On the ground-floor was the kitchen, with a wall of rough planks of raft wood, not touching each other; so that the whole fabric was abundantly ventilated, and only too often filled with fog, causing coughs, aching limbs, and mouldy clothes.

This was their head-quarters during the time that they were collecting seeds and plants; and the severe hardships, miserable lodging, and acute sufferings from illness must increase our admiration for Mr. Spruce's zeal and resolution in performing this great public service.

Mr. Cross, the gardener whom I had engaged to assist Mr. Spruce, conveyed the fifteen Wardian cases, which I had previously sent to Guayaquil, up the river as far as Ventanas, and reached Limon on the 27th of July.

In the mean while Mr. Spruce had carefully examined the chinchona forests, and visited all the bark-trees known to exist within reach of Limon. He found a good crop of capsules on many of them, which had already nearly reached their full size on the finest trees; on others, however, there were only very young capsules, and even a good many flowers, and not one of the late-flowering panicles produced ripe capsules. On the tree which bore most capsules they began to turn mouldy, the mould being not fungi, but rudimentary lichens, which, whilst it proved that the capsules were still alive and growing, proved also that they were exposed to an atmosphere almost constantly saturated with moisture.

The *manchon* or clump of "red-bark" trees at Limon lies nearly west from the peak of Chimborazo, and the river Chasuan rises on the northern shoulder of that mountain. The view from Limon takes in a vast extent of country, and the whole is unbroken forest, save towards the source of the Chasuan, where a lofty ridge rises above the region of arborescent vegetation, and is crowned by a small breadth of grassy *paramo*. The waters of the Chasuan run over a black or dull blue, shining, and very compact trachyte, over which, in the bottom of the valleys at Limon, there is a fine-grained ferruginous

sandstone of a deep brown colour, in thick strata. The soil is a deep loamy alluvial deposit. The ridges on which the "red-bark" trees grow all deviate a little from an easterly and westerly direction, and the chinchonæ are far more abundant on the northern than on the southern slopes. The northern and eastern sides of the trees, too, had borne most fruit, and scarcely a capsule ripened on their southern and western sides. This is explained by the trees receiving most sun from the east and north, the mornings being generally clear and sunny in the summer, whilst the afternoons are foggy, and the sun's declination is northerly. Mr. Spruce also observed that the trees standing in open ground were far healthier and more luxuriant than those growing in the forest, where they are hemmed in and partially shaded by other trees; and he concludes, from this circumstance, that, though the "red-bark" tree may need shade whilst young and tender, it really requires (like most trees) plenty of air, light, and room wherein to develop its proportions.

The lowest site of the "red-bark" tree at Limon is at an elevation of 2450 feet above the sea, and its highest limit is at an elevation of about 5000 feet. The trees nearest the plain are generally the largest, but those higher up have much thicker bark in proportion to their diameter.

The havoc committed by the bark-collectors on these trees within the last twenty years has been very great. The entire quantity of "red bark" collected in 1859 did not reach to 5000 lbs., and in 1860 no "red bark" at all was got out, so that the trade is nearly extinct. In the valleys of the Chasuan and Limon Mr. Spruce saw about 200 of these trees standing, but only two or three were saplings which had not been disturbed; all the rest grew from old stools, whose circumference averaged from 4 to 5 feet. He was unable to find a single young plant under the trees, although many of the latter bore signs of having flowered in previous years; and this was explained by the flowering trees invariably growing in open places, where the ground was either weeded, or trodden down by cattle.

Mr. Spruce describes the *C. succirubra* or "red-bark" tree as very handsome, and he declares that, in looking out over the forest, he could never find any other tree at all comparable to it for beauty. It is fifty feet high, branching from about one-third of its height, with large, broadly ovate, deep green, and shining leaves, mixed with decaying ones of a blood-red colour, which give it a most striking appearance.

The *Cascarilla magnifolia*, a very handsome tree, with a fragrant white flower, grows abundantly with the "red bark," and attains a height of 80 feet.

After the arrival of Mr. Cross at Limon the work of collecting commenced in earnest. A piece of ground was fenced in, and Mr. Cross made a pit and prepared the soil to receive cuttings, of which he put in above a thousand on the 1st of August and following days; and he afterwards went round to all the old stools and put in as many layers from them as possible. "But," as Mr. Spruce most truly observes, "only those who have

attempted to do anything in the forest, possessing scarcely any of the necessary appliances, can have any idea of the difficulties, and Mr. Cross's unremitting watchfulness alone enabled him to surmount them."

Towards the end of July, in a few sunny days, the fruit of the "red-bark" trees made visible advances towards maturity; and in the middle of August the capsules began to burst at the base, and appeared ripe. An Indian was then sent up the trees, and, breaking the panicles gently off, let them fall on sheets spread on the ground to receive them, so that the few loose seeds shaken out by the fall were not lost. The capsules were afterwards spread out to dry for some days on the same sheets. In September Mr. Spruce went across to the valley of the San Antonio, to the southward, in order to secure additional seeds from "red-bark" trees there, leaving Mr. Cross to watch over the rooting of the cuttings at Limon. Between the 14th and 19th he gathered 500 well-grown capsules at San Antonio, in addition to 2000 already collected at Limon. Good capsules contain forty seeds each, so that at least 100,000 well-ripened and well-dried seeds were now gathered; and on the 28th of September Mr. Spruce started for Guayaquil.[370] In November he proceeded up the river again, and purchased one of the rafts at Ventanas, which are used for conveying cacao to Guayaquil. It was composed of twelve trunks of raft-wood, sixty-three to sixty-six feet long and one foot in diameter, kept in their places by shorter pieces tied transversely, and covered with bamboo planking, fenced round with rails to a height of three feet, and roofed over. The rope used for binding the parts of the raft together was the twining stem of a *Bignonia*. The Wardian cases were got ready on the raft at Ventanas, and Mr. Cross arrived with the plants from Limon on the 13th of December, and established them in the cases to the number of 637.

After encountering several dangers and mishaps in navigating the river, the raft with its precious freight reached Guayaquil on the 27th of December; and the plants were safely embarked on board the steamer, in charge of Mr. Cross, on the 2nd of January, 1861.

Thus skilfully and successfully did Mr. Spruce, and his able colleagues, perform this most difficult and important service. Mr. Spruce, during the whole time that he was in the chinchona forests, made most careful meteorological observations. From June 19th to December 8th the results of observations of the thermometer were as follows:—

Mean minimum	61½°	
Mean maximum	72⅓	
Mean temperature at 6½ P.M.	67¾	
Highest temperature observed	80½	on July 27th.
Lowest temperature observed	57	on July 11th.
Entire range	23½	
Mean daily variation	10½	

On the western side of the Quitenian Andes, south of the Equator, the summer or dry season lasts from June to December, the remaining five months constituting the wet season. In the summer, at Limon, the early part of the day is often sunny, and fogs come on in the afternoon and night; but in the wet season there are fogs in the morning, and heavy rains during the rest of the day and night.

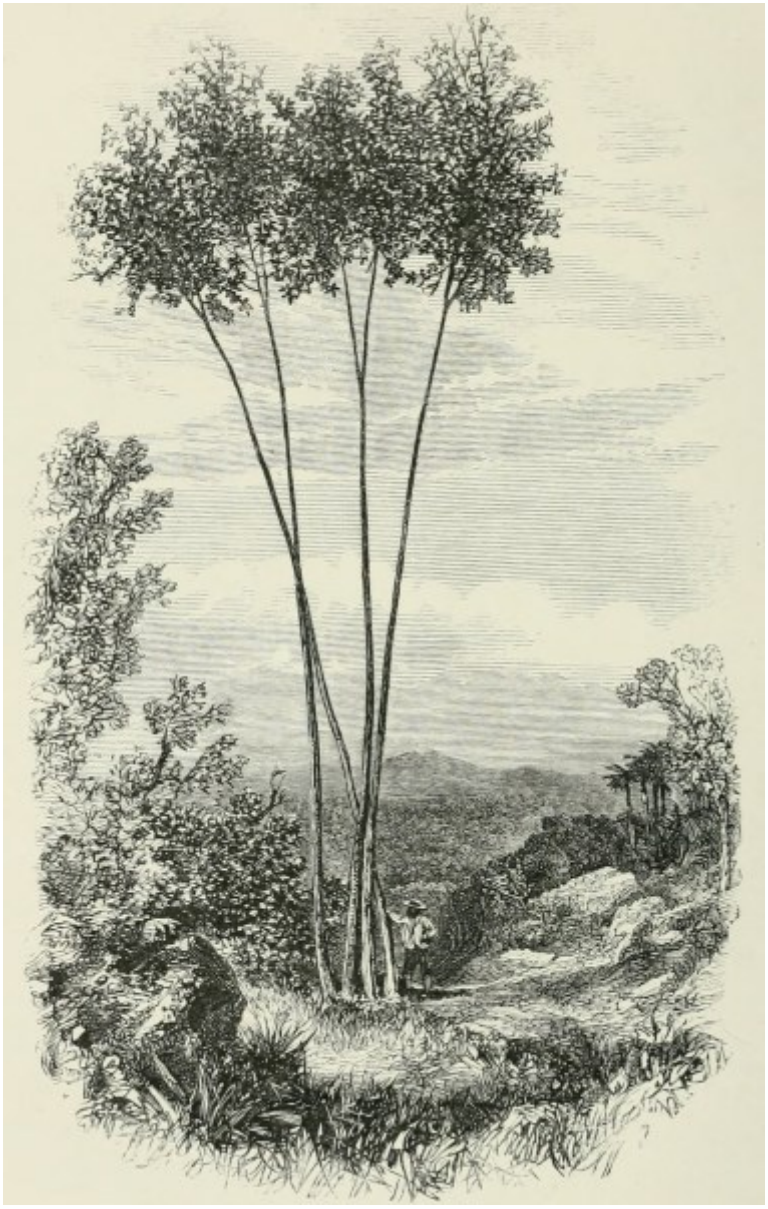
A perusal of the foregoing pages, which are nothing more than a brief abstract from Mr. Spruce's official reports, cannot fail to impress the reader with the valuable nature of the service which has been performed, and with the energy and fortitude, combined with great skill and ability, which enabled Mr. Spruce to overcome so many difficulties; and almost equal praise is due to Mr. Cross. But in recounting these arduous labours, only half of Mr. Spruce's services have been recorded. That gentleman is an accomplished botanist, and most accurate observer; and he has supplied us with a detailed report which, I do not hesitate to say, contains a larger amount of valuable information on the chinchona-forests than any account which has yet appeared in Europe. In addition to the narrative of his proceedings, and his observations on the "red-bark" tree, Mr. Spruce here gives a minute account of the vegetation of the "red-bark" forests of Chimborazo, a detailed meteorological journal, and important remarks on the climate and soil.[371]

My apprehensions respecting the feelings of the natives, when our proceedings became known, were fully justified by what took place in Ecuador, as well as in Peru. But the South Americans are, as a rule, remarkable for the slowness of their movements; and it was not until May 1st, 1861, that the legislature of Ecuador decreed that every person, whether foreigner or native, should be forbidden to make collections of plants, cuttings, or seeds of the quina-tree; and that precautions should be taken to prevent those articles from passing the ports and frontiers of the Republic. A fine of 100 dollars on every plant, and every drachm of seed, was imposed on those who attempted to break this decree. But by May 1st, 1861, the plants and seeds of the quina-tree were safe on the Neilgherry hills, in Southern India.

While Mr. Spruce was engaged in collecting these seeds and plants in the forests at the foot of Chimborazo, Mr. Pritchett, whose services I had secured for the Huanuco region in Northern Peru, was employed on the species of chinchonæ yielding grey bark.

Mr. Pritchett left Lima on the 18th of May, 1860, and arrived in the town of Huanuco, the centre of the grey-bark region, on the 28th, where he made the necessary preparations for a journey into the neighbouring forests. On the 9th of June he set out for the mountain-range of Carpis, to the northward, where there are several species of chinchonæ. The *C. purpurea* is very abundant; the *C. nitida* is common on the north-east side, and on the upper part of the mountains; the *C. obovata* is more rare; and the *C. micrantha* and *C. Peruviana* are both inhabitants of the lower slopes. After crossing the Carpis range, Mr. Pritchett followed the course of the river of Casapi to the village of

Chinchao, and went thence to the coca estate of Casapi, at the eastern end of the valley, where it joins that of the river Huallaga, and here he was joined by his guide.



CHINCHONA NITIDA TREES.

FROM A SKETCH BY MR. PRITCHETT.

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About three leagues from Casapi, and close to the Huallaga, is the mountain called San Cristoval de Cocheros (Cuchero of Pavon and Poeppig), which rises from the low land at the junction of the two rivers to a height of about 1200 feet above them, and is the centre of the bark district of Huanuco. On the northern side Mr. Pritchett found abundance of *C. micrantha*, and some trees of *C. Peruviana*; but the latter species was much more rare. They both grow to a very large size, some of them being thirty inches in diameter and seventy feet in height. The trees of *C. nitida* were at a higher elevation.

During June and July, though it was the dry season, heavy rains continued to fall from day to day; but towards the end of July the weather broke up, and the sun began to make an impression on the solid banks of cloud which filled the valleys, and then it was that, during some portion of the day, the sun penetrated to the very underwood of the forest. In the first half of August there was fine weather, with only an occasional shower. The seeds on the chinchona-trees ripened rapidly in the sunshine, and Mr. Pritchett collected them by felling the trees—a labour which was performed by Indians, whom he hired from the coca estate of Casapi. Seven large trees were cut down daily, and denuded of their capsules, for a fortnight; the drying process being carried on at the estate, where every moment of sunshine was taken advantage of. On the 13th of August he started for the coast with his collection of seeds, and half a mule-load of young chinchona-plants, which were in perfect health when placed in the Wardian cases at Lima.

Mr. Pritchett reports that in the district around Cocheros, Casapi, and Carpis, the rocks are of crystalline formation, in many localities highly disintegrated, and composed of masses of hornblende, felspar, and mica. He remarks that felspar contains much potash, of which the chinchona-trees are said to require a large quantity for their full development; and, as felspar abounds in this region, he attributes the abundance and size of the chinchona-trees to this circumstance. He also reports that steatite, a silicate of magnesia and alumina, abounds in the vicinity of Huanuco.

He describes the climate as moist and warm, and says that the difference in the degree of moisture and warmth between the lower slopes where the *C. micrantha* flourishes, and the higher parts of the mountains inhabited by the *C. nitida*, is very striking, while on the lower slopes the soil is much deeper and richer.[372] He reports the elevation of Cocheros above the level of the sea to be about 4000 feet,[373] but he made no meteorological or other observations; and I think there can be no doubt that the elevation of that mountain is much greater than Mr. Pritchett supposes. I do not find any information on this point in Poeppig's travels; but the Huanuco region is quite a beaten track, and there are several accounts of it by modern travellers. Huanuco itself is 6300 feet above the sea;[374] the distance thence to the summit of the cuesta del Carpis, which is 8000 feet above the sea, is about twenty miles, and there is a descent on the other side into the valley of the Casapi of 2920 feet.[375] According to this account the village of Chinchao, in the Casapi valley, would have an elevation of about 5000 feet. From Chinchao to the foot of the Cocheros mountain is a distance of twenty-five miles down the Casapi valley,[376] a gentle descent, with numerous cottages and plantations on both sides of the road.[377] Thus the foot of the Cocheros mountain would be about 4500 feet above the sea, and its summit at least 6000 feet.

We shall not, therefore, be very far from the truth if we place the region of *C. nitida* on the Cocheros and Carpis mountains at from 6000 to 7000 feet above the sea, and of *C. micrantha* at from 4000 to 5000 feet.

Mr. Pritchett performed the portion of this important undertaking which I intrusted to him with promptitude and zeal. Time was a great object, and, by going direct from Lima to the best locality in the Huanuco chinchona region, he completed the necessary collection of plants and seeds, and returned to the coast in little more than three months. [378] This shows how essential a previous knowledge of the chinchona region, of the people, and of the language, was, without which the collector would probably lose much time, which is the same thing as spending much money, and eventually wander into a locality where only worthless species are found, as was the case with the Dutch agent.

Owing to the unavoidable abandonment of Mr. Spruce's intention of sending Dr. Taylor to collect seeds of *C. Condaminea* at Loxa, one portion of my scheme for introducing all the valuable species into India remained incomplete at the close of 1860. On my return from India, therefore, in May 1861, I obtained the sanction of the Secretary of State for India to take measures for obtaining a supply of seeds from the Loxa forests. Mr. Cross, the gardener who had so ably assisted Mr. Spruce, and shared his labours, after safely depositing the collection of seeds and plants in India, had returned to South America, attracted by the richness and variety of the flora of the Andes. Having acquired experience of the people and language, of the localities where chinchona-trees are found, and of the mode of travelling, during his former visit, he possessed the necessary qualifications; and, as Mr. Spruce was too ill to undertake the work, it was intrusted to Mr. Cross, who performed it with expedition and success. He is an excellent practical gardener, intelligent and persevering, ardently devoted to his profession, and thoroughly trustworthy.

On the 17th of September, 1861, Mr. Cross left Guayaquil in an open rowing boat, and landed at Santa Rosa, the port of the province of Loxa, whence he proceeded, by way of Zaruma, to the town of Loxa, which he reached on the 27th. He had to pass through dense swampy forests, over dangerous precipitous ridges of the Andes, in crossing one of which his mule slipped down a deep ravine and was dashed to pieces, and along barren lofty plains. He mentions that during the ascent to Zaruma he saw several "red-bark" trees growing at an elevation of eight or nine thousand feet.

On the 1st of October he left Loxa, and went to a long low ridge of hills, called the Sierra de Cajanuma, about eight miles to the southward, a locality which is mentioned by Humboldt, Bonpland, and Caldas, as the abode of the most valuable kinds of *C. Condaminea*. He came to an Indian hut on a little rounded eminence near the summit of the mountain, which, being far from public roads or other dwellings, seemed well suited for his head-quarters during the time that he was searching for seeds. For be it remembered that the Decree of May 1st, 1861, already mentioned, was in full force, and that he was running the risk of fine and imprisonment in performing this important service. The owner of the hut, who was an experienced bark-collector, allowed Mr. Cross to establish himself in a little shed at one end of it, which, although favourable for

drying seeds, was so cold that he was sometimes compelled, during windy nights, to seek shelter in the bottom of a neighbouring ravine.

After many comparatively unsuccessful searches in the surrounding woods, he was one day passing along the bank of a steep ravine, and, happening to look over a projecting rock, he saw a number of fine young trees of the *C. Condaminea* on the steep slope beneath, some of which bore a few panicles of seeds, which, on examination, he found to be perfectly ripe. After this discovery he continued to search all the ravines in the vicinity from sunrise to sunset, some of which he had to descend by means of the trailing stems of a species of *Passiflora*, and in this way a good supply of seeds was collected. He reports that on the accessible slopes there are few chinchona-trees, owing partly to the annual burning, and partly to continual cropping of the young shoots by cattle. He describes the rocks, composed of micaceous schist and gneiss, as being, in many places, in a state of decomposition, and states that large portions are frequently tumbling down from the more elevated summits. The alluvial deposit in the ravines, where the *C. Condaminea* is found growing, is shallow, in many places not more than six inches in depth, and Mr. Cross often gathered seeds from trees which were growing in clefts of rock, where there was not a single ounce of soil to be found. He describes the *C. Condaminea* as a slender tree, from 20 to 30 feet in height,[379] and from 8 to 10 inches in diameter at the base; but he saw few trees of these dimensions, and the plants from which the bark of commerce is now taken are in general not more than 8 to 10 feet in height.[380] When the plants are cut down, three or four young shoots or suckers generally spring up, but this does not always happen, as some of the more industrious bark-collectors frequently pull up the roots, and bark them also. The bark is taken from the smallest twigs, and thus the annual growths are often taken, especially if they are strong. The plants are sometimes found growing in small clumps, and sometimes solitary, but always in dry situations.

The temperature of this region ranges according to Humboldt and Caldas from 41° to 72° Fahr., and according to Mr. Cross from 34° to 70° Fahr.; but he adds that it seldom falls below 40°, and rarely rises above 65°; the mean range being from 45° to 60° Fahr. The climate of Loxa is very moist. The wet season commences in January and lasts until the end of April or middle of May; in June, July, and August there are heavy rains, accompanied by strong gales of wind; from September to January there is generally fine weather, but occasional showers of rain fall even at that time of year.[381]

The vegetation on the Sierra de Cajanuma is of a semi-arborescent character, but some of the higher summits are bare. In the bottoms of the ravines grow a species of *Alnus*, *Melastomæ*, *Peperomias*, palms, and two species of tree ferns; and on the slopes throughout the low-lying country, barley, maize, peas, and potatoes are cultivated. Mr. Cross sent home a large collection of dried specimens of plants gathered on the Sierra de Cajanuma. Among them I observed a *Befaria* with pretty crimson flowers, of which

he says that one ounce of the roots in two pints of water is taken twice a day by the Indians for dysentery; a very handsome purple lupin, growing six to eight feet high; an *Embothrium*, a wide-spreading shrub, growing in dry situations; another smaller *Befaria*, a beautiful shrub, growing in very lofty dry localities; a *Veronica*, a shrub six to eight feet high, with a blue flower; a *Gaultheria*; a wide-spreading *melastomaceous* plant, with inconspicuous flowers; and a number of *Lycopodia* and ferns.

CHINCHONA CHAHUARGUERA.
(From Howard's 'Nueva Quinologia de Pavon.')

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Besides the seeds of the *C. Condaminea*, which is identical with the *C. Chahuarguera* (Pavon), Mr. Cross succeeded in collecting a few seeds of *C. crispa* (Tafalla) after several long journeys up the mountains. He found this kind growing at a great elevation, in a deposit of peat, where the temperature sometimes falls to 27° Fahr. This species of

chinchona yields the *cascarilla crespilla negra*, one of the most esteemed forms of Loxa bark. Mr. Howard[382] mentions that the *Josephiana* bears the same relation to the normal *C. Calisaya* as the *Crespilla* bark at Loxa does to the normal and full-grown *C. Chahuarguera*.

Mr. Cross did his work right well, and in December, 1861, he returned to Guayaquil with nearly 100,000 seeds of *C. Chahuarguera*, and a smaller parcel of *C. crispa*, which were forwarded to India by way of Southampton.[383]

Thus were the various operations which I organized for procuring the valuable species of chinchona-trees in South America satisfactorily completed; and the labours of Mr. Spruce, Dr. Taylor, Mr. Pritchett, Mr. Cross, and Mr. Weir, though differing in value and importance, all deserve the warmest recognition, for all those intrepid and courageous explorers worked zealously and successfully, and did good service in furthering this most important public enterprise.

CHAPTER XX.

CONVEYANCE OF CHINCHONA-PLANTS AND SEEDS FROM SOUTH AMERICA TO INDIA.

Transmission of dried specimens—Voyages of plants in Wardian cases—Arrival of plants and seeds in India—Depôt at Kew—Treatment of plants in Wardian cases—Effects of introduction of chinchona-plants into India on trade in South America—Neilgherry hills.

THE attempt to make simultaneous collections of seeds and plants of all the valuable species of chinchonæ was thus crowned with almost complete success. Out of my original scheme the *C. lancifolia* of New Granada was the only one which had not been procured. It is unnecessary to say more respecting the numerous difficulties and dangers which were encountered by the collectors, for the narrative of the proceedings detailed in previous chapters will have made these sufficiently obvious. So far as the labours in South America were concerned, all obstacles were surmounted, and the objects of this great enterprise were fully attained. Not only were plants and seeds safely brought to the coast, but, in every instance, the collectors took care to provide themselves with botanical specimens from the chinchona-trees. Thus the leaves, flowers, fruit, and bark of each species, which were brought to England, placed the identity of the valuable species to which the plants and seeds belonged beyond the remotest possibility of a doubt.[384] But in conveying these precious mule-loads to the coast of Peru, and safely embarking them, only half the difficulties had been overcome; and I could not but feel that some failures and disappointments must be expected before the chinchona-plants were fairly established in India.

There was not much reason for apprehension with regard to the seeds; but the plants, in the absence of any provision for conveying them direct across the Pacific, had to undergo an ordeal of unprecedented duration. Yet the great advantage of introducing plants as well as seeds, in the immense start they would give to the young plantations in India, was strongly felt, and the complete success that attended the hazardous transit of at least one relay, which came under peculiarly favourable circumstances, fully justified the attempt.

I gave directions to Mr. Spruce and Mr. Pritchett to send small parcels of seeds of each species to Jamaica and Trinidad, in obedience to an order received from England, so that quinine-yielding trees might also be introduced into our West Indian colonies; and the results of the experiment in those islands will be given in a future chapter. The great bulk of the collections, however, were despatched to India, by the roundabout way of Southampton, directly they arrived on the coast of the Pacific.

The thirty Wardian cases which I sent out round Cape Horn were three feet two inches long, ten feet ten inches broad, and three feet two inches high; and, with soil and plants, each case weighed a little over three hundredweight. The collection of plants of *C. Calisaya*, *C. ovata*, and *C. micrantha* filled fifteen cases; and the other fifteen received the collection of *C. succirubra* at Guayaquil. I also had six cases of somewhat smaller dimensions constructed at Lima for the plants from Huanuco. The fifteen cases containing the collection of chinchona-plants from Caravaya sailed from the port of Islay on the 23rd of June, and reached Panama on the 6th of July, 1860, when 207 had already begun to throw out green shoots. On their arrival in England, in August, these 207 plants were in a most flourishing and healthy condition, and continued so until their arrival at Alexandria early in September. But the intense heat of the Red Sea, where the thermometer ranged from 99° in the night to 107° in the day-time, proved too much for them, and the damage was increased by a detention of a week at Bombay. Their roots were attacked by rot, yet, on their arrival in the Neilgherry hills, their leaves still looked fresh, and several hundred green cuttings were obtained from them, which, however, failed to strike. The cases containing the chinchona-plants from Huanuco left Lima in September, and were also in a most promising state when they reached England, but on their arrival in India they were all dead. The "red-bark" collection, under the able management of Mr. Cross, sailed from Guayaquil on the 2nd of January, 1861. On their arrival in England in excellent order, six of them were left at Kew as a precaution, and replaced by six plants of *C. Calisaya* supplied by Sir W. Hooker. At that season the climate of the Red Sea is cool, and, owing to this circumstance and still more to the intelligent watchfulness of a good practical gardener, 463 plants of *C. succirubra* and six of *C. Calisaya* were handed over to the superintendent on the Neilgherry hills, in as vigorous and healthy a condition as could possibly have been hoped for after such a voyage.

The "grey-bark" seeds arrived in the Neilgherry hills early in January, 1861, and the "red-bark" in the following March, and both collections came up abundantly. The supply of seeds of *C. Condaminea* reached their destination in Southern India in February 1862. In order to guard against all accidents, a portion of the seeds of each species was left in England, and a depôt of young chinchona-plants has thus been formed at Kew Gardens, with a view to fall back upon them in the event of possible failures or misfortunes in India.[385] Seeds of each of the species were also sent to Ceylon, to which Sir W. Hooker added a few plants of *C. Calisaya* from his stock at Kew.

Thus, in spite of one or two disappointments, the great object of the undertaking sanctioned by the Secretary of State for India was fully attained. By the spring of 1861 a large supply of plants and young seedlings was established in the Neilgherry hills; and at the present moment we have thousands of chinchona-plants, of all the valuable species, flourishing and multiplying rapidly in Southern India, and in Ceylon. When the unprecedented length of the voyages and the numerous trans-shipments are taken into

consideration, the wonder is that any of the plants should have been successfully conveyed from the slopes of the Andes in South America to the ghauts in Southern India, over thousands of miles, through every variety of climate, and subject to the risk of crossing the isthmus of Panama, of changing steamers at the island of St. Thomas, at Southampton, at Suez, and at Bombay, and of the journey through Egypt.

The most important introduction of plants into India, by means of Wardian cases, previous to the arrival of the chinchonas, was that of the tea from China in 1849 and following years by Mr. Fortune. On those occasions the cases were strongly and coarsely made, the glass shades firmly fixed, and the glass itself thick, and glazed in pieces of moderate size. The frames were protected by a grating of iron wire, with a canvas covering capable of being unrolled so as to screen the plants from the direct rays of the sun, if necessary. The soil was not less than eight or ten inches deep, and kept down by cross-battens, and the plants were fairly established in it before starting. In 1849 Mr. Fortune sowed large quantities of seeds in the cases, between rows of young plants, which germinated on their way from China to India, and reached their destination in the Himalayas in good condition. Out of 250 tea-plants, 215 arrived in perfect order. [386]

But it was an easy process to convey plants by the short voyage from China to Calcutta, when compared with the introduction of plants from the western coast of South America into India; and the performance of the latter feat, in the case of the chinchona-plants under Mr. Cross's care, is undoubtedly the most extraordinary success of the kind that has yet been achieved.

A few remarks on the treatment of plants in Wardian cases were supplied to me by Mr. Weir and Mr. Cross, who acquired their experience in the voyages from South America to India; and by Mr. McIvor, who received the plants on the Neilgherry hills. The cases were filled with soil to a depth of nine to ten inches, in which the chinchonas were planted in rows, from the back to the front of the case. The distance from plant to plant was regulated by their size, but, in the case of their having much foliage, they should be rather wide apart, for the crowding of foliage is always injurious, and often brings on mildew or mould. After having been planted they were well watered, and shaded from the glare of the mid-day sun. On the surface of the soil, between each row of plants, a batten was placed, extending from the back to the front of the case, and held firmly down by two longer battens extending lengthways. By this means the soil and plants are not disturbed in the operation of moving the cases. When the cases are finally closed the soil should be in a medium state as regards moisture, and all dead foliage should be removed. The cases should be made as air-tight as possible by filling the seams with putty, and every precaution must be taken to preserve the plants from the slightest contact with salt water.[387] Mr. McIvor strongly recommends that the cases should be furnished with a false bottom, raised about two or three inches above the true bottom,

by bars of wood of the required thickness being nailed on the underside. The false bottom should have holes bored in it at regular intervals, with a few broken pieces of pot and a layer of moss placed over them. He considers that the best sort of soil is formed of equal parts of leaf-mould, turfy loam, and sand, mixed in a dry state, and spread out and exposed to the action of the sun for a few days before being placed in the cases. During the voyage the plants should have plenty of light and air, one side of the case being left open for two or three hours, morning and evening, during fine weather, when dead leaves should be picked off, and water administered to any plant which may require it. The soil should be turned up on the surface to the depth of about half an inch with a small pointed stick every three or four days, and always kept rough on the surface, so as to allow the air to circulate in the soil. This circulation of air is also facilitated by the false bottom. The action of the air on the soil keeps the roots in fine condition, and entirely prevents the formation of mildew and damp; but the principal object of the false bottom is to allow any excess of water to drain off into a place where it cannot *sour* the soil, and yet will not be lost. Then, as the soil becomes dry above, the water will be attracted to it.

With the exception of the false bottom, all the above suggestions were carefully attended to by the gardeners who were in charge of the chinchona-plants during the voyage to India; the partial failures which attended some of the relays from South America could not, under the circumstances, have been avoided by any human foresight; and, as the general result of my arrangements has been to introduce all the valuable kinds of quinine-yielding plants into India, we have every reason to congratulate ourselves on the success of our labours.

With the chinchona-plants I brought from Peru a supply of seeds of the chirimoya, of aji-pepper, and of the *Schinus molle*, all of which are coming up well on the Neilgherry hills.[388] They have most of the other kinds of *Anonas* in India, but the chirimoya fruit, the most exquisite of all, has yet to be raised. He who has not tasted the chirimoya has yet to learn what fruit is. "The pine-apple, the mangosteen, and the chirimoya," says Dr. Seemann, "are considered the finest fruits in the world. I have tasted them in those localities in which they are supposed to attain their highest perfection—the pine-apple in Guayaquil, the mangosteen in the Indian archipelago, and the chirimoya on the slopes of the Andes; and, if I were called upon to act the part of a Paris, I would without hesitation assign the apple to the chirimoya. Its taste indeed surpasses that of every other fruit, and Haenke was quite right when he called it the masterpiece of nature."[389]

In obtaining plants and seeds of these valuable chinchonas from South America, it would be a source of deep regret to me if that measure was attended by any injury to the people or the commerce of Peru or Ecuador, countries in the welfare of which I have for years taken the deepest interest. But I have no apprehension that such will be the result of the cultivation of these plants in other parts of the world. The demand for quinine

will always be in excess of the supply from South America; and the result of chinchona cultivation in India and Java will have the effect of lowering the price, and bringing this inestimable febrifuge within the reach of a vast number of people who are now excluded from its use, without in any way injuring the trade of Peru and Ecuador. I trust that not only will this measure do no injury to the South Americans, but that it may be hereafter productive of good to them, as well as to the rest of mankind. Hitherto they have destroyed the chinchona-trees in a spirit of reckless short-sightedness, and thus done more injury to their own interests than could possibly have arisen from any commercial competition; but it may be that the influence of peace and education will inaugurate a new system in time to come, that more enlightened views will prevail, and that they themselves may undertake the cultivation of a plant which is indigenous to their forests, but which, up to this time, they have so foolishly neglected. It will then be a pleasure to supply them with the information which will have been gained by the experience of cultivators in India, and thus to assist them in the establishment of plantations on the slopes of the eastern Andes.

Under any circumstances the South Americans, who owe to India the staple food of millions of their people, and to the Old World most of their valuable products—wheat, barley, apples, peaches, sugar-cane, the vine, rice, the olive, sheep, cattle, and horses—have no right to desire to withhold from India a product which is so essentially necessary to her welfare. Nor do I believe that the better conditioned Peruvians have any such desire. On the contrary, many of them have shown themselves willing to promote a friendly interchange of the products of the New and Old Worlds; and the foolish decree issued in Ecuador on the 1st of May, 1861, as well as the numerous obstructions thrown in my way in southern Peru, may be imputed either to the narrow-minded selfishness of half-educated officials, or to the ignorant patriotism of backwoodsmen. These are feelings which are not shared by either the educated few, or by the Indian population.

After much careful consideration it had been decided that the best place for commencing the experimental cultivation of chinchona-plants in India would be the Neilgherry hills, in the Madras Presidency. Here are to be found a climate, an amount of moisture, a vegetation, and an elevation above the sea, more analogous to those of the chinchona forests in South America than can be met with in any other part of India. In the Government gardens at Ootacamund, on the Neilgherries, there were the necessary conveniences for propagating plants and raising seedlings; and in Mr. William G. McIvor, the Superintendent, was to be found a zealous, intelligent, and practical gardener, who had carefully studied the botany of the chinchona genus, and under whose care the cultivation would be commenced with the best possible guarantees for its success.

From the Neilgherries the chinchona-plants will, it is hoped, be introduced into such other hill districts of Southern India as, after examination, may be found suitable for their growth; and it was a part of my duty to visit the most promising localities, and, in conjunction with Mr. McIvor, to select the sites for chinchona plantations on the Neilgherry hills. With this object in view we landed at the port of Calicut, on the coast of Malabar, on the 7th of October, 1861.

TRAVELS IN INDIA.

CHAPTER XXI.

MALABAR.

Calicut—Houses and gardens—Population of Malabar—Namburi Brahmins—Nairs—Tiars—Slaves—Moplahs—Assessment of rice-fields, of gardens, of dry crops—Other taxes—Voyage up the Beypoor river—The Conolly teak plantations—Wundoor—Backwood cultivation—Sholacul—Sispara ghaut—Black-wood—Scenery—Sispara—View of the Nellemboor valley—Avalanche—Arrival at Ootacamund.

He who would desire to receive the most pleasant impression of India, on a first arrival, must follow in the wake of Vasco de Gama, and land on the coast of Malabar, the garden of the peninsula. Here Nature is clad in her brightest and most inviting robes, the scenery is magnificent, the fields and gardens speak of plenty, and the dwellings of the people are substantial and comfortable.

As we steamed into the anchorage at Calicut, on board the little yacht 'Pleiad,' no appearance of any town was visible, and no building except a tall white lighthouse. Thick groves of cocoanut-trees line the shore, and are divided from the sea by a belt of sand; while undulating green hills rise up behind, and the background of mountains was hidden by banks of clouds. The whole scene bore a close resemblance to one of the Sandwich or Society Islands, down to the canoes which came off to us the moment the anchor was let go. They are hewn out of the trunk of the jack-tree, with an upper bulwark fastened with coir twine; and the canoe-men were naked athletic-looking fellows, with enormous hats made of a frond of the tallipot palm (*Corypha umbraculifera*). When we shoved off from the 'Pleiad' a handsome fish-hawk, with white head and breast, was perched on the fore-topsail yard-arm, and sea-snakes were playing in the water alongside. In-shore there were a few native craft, called *pattamars*, at anchor. Pattamars are the vessels which have carried on the coasting trade on the western side of India from time immemorial. As in the days of Sinbad the sailor, their planks are not nailed, but sewn together with coir-twine, and they have high sterns and bows sheering rapidly aft. The deepest part is at the stem, whence the bottom curves inwards to the stern. A pattamar has two masts raking forward, with long picturesque lateen yards slung with one-third part before the mast, and two-thirds abaft. They never attempt to tack, but always ware, and if taken aback there is no alternative but either to wait until she comes round, or to capsize.

On landing at Calicut, a carriage drawn by two white bullocks was, through the hospitality of Mr. Patrick Grant, the Collector of Malabar, waiting for us on the sandy beach, to convey us to his house; a drive of about two miles. The excellent road, of a bright red colour from the soil being composed of laterite, passes through groves of

cocoanut-trees, interspersed with many houses, each surrounded by its garden of mangos, nux vomica trees, jacks with pepper-vines creeping over them, and palm-trees. The houses are all substantial and comfortable-looking, built of square blocks of laterite joined with *chunam*, or lime made from calcined sea-shells, and roofed with tiles. The laterite or iron-clay is a rock full of cavities and pores like coral, overlying the granite which forms the basis of Malabar. When excluded from the air it is so soft that any iron instrument can readily cut it, and is dug up in square masses with a pickaxe, and afterwards shaped into blocks with a knife or trowel. After exposure it soon becomes as hard, and is as durable as bricks. Each house has a cocoanut safe or store-room on one side, of open wood-work. Many people were walking along the road, naked men with huge tallipot-palm hats, and women with nothing on but bright-coloured petticoats, looking picturesque in the foreground and middle distance of the palm-shaded vistas. At intervals the cocoanut groves were broken by fields of vivid green paddy, and tanks filled with red lotus-flowers.

From Mr. Grant's house, on the top of a rounded grassy hill, there is an extensive and very beautiful view of the undulating hills and dales of Malabar, generally covered with forest; with the ocean on one side, and the Wynaad mountains on the other. Malabar is 188 miles long, 25 miles broad in the northern, and 70 in the southern half, and contains 6262 square miles. It is divided into 17 *Talooks* or districts, and has a population of 1,602,914 souls; of whom 1,165,174 are Hindus, 414,126 Moplahs, and 23,614 Christians.

The people of Malabar are a thriving active race, the men well built and handsome, and the women remarkable for their beauty. The highest caste among the Hindus is that of the Namburi Brahmins, who claim all the land below the ghauts, and appear to have actually possessed a large portion of it previous to the invasion of Hyder Ali of Mysore. They declare that when Parasu Rama, one of the incarnations of Vishnu, hurled his axe from the mountains, the ocean receded, leaving the land of Kerala, as Malabar, Cochin, and Travancore were called; which he gave to the Namburi Brahmins. It is true that the undulating flat-topped hills, which cover the part of Malabar near Calicut, are like the waves of the sea, and appear as if the ocean in receding had forced channels, and thus formed the intervening valleys. The Namburis are fast dying out: they are landed proprietors, and perform such offices as bestowing holy water and ashes, or performing *poojah* or worship for the other Hindus, but never enter the public service.

The most important portion of the population is included in the eleven classes of Nairs, [390] a race of pure Sudra caste. They pretend to be born soldiers, and formed the armies of the Zamorin and Cochin Rajahs, the lower castes not being allowed to bear arms. The Nairs now hold most of the land in Malabar, and are frequently very rich. Both the Zamorin of Calicut and the Rajah of Cochin are Nairs; and the origin of their rule is said to have been as follows. About a thousand years ago, a Viceroy of the Sholum Rajah

ruled over Malabar, named Cheruman Permal, who made himself independent, and divided the country among his nobles, of whom five were of the Kshatri caste, and seven were Nairs. After the division it was found that one of his bravest officers, the ancestor of the present Zamorin or Tamori Rajah, had been left out; Cheruman Permal, therefore, gave him his sword, and all the territory in which a cock crowing at a certain small temple could be heard. Hence Calicut, from *Colicodu*, a cock-crowing.[391] Down to the time of Tippoo the whole of Malabar was governed by the descendants of the sisters of these thirteen Nair chiefs. The Zamorin of Calicut has some influence, though he is much reduced in wealth and importance since the days of Vasco de Gama.

The Nairs live under the remarkable institution called *murroo-muka-tayum*. Sisters never leave their homes, but receive visits from male acquaintances, and the brothers go out to other houses, to their lady-loves, but live with their sisters. If a younger brother settles in a new house, he takes his favourite sister with him, and not the woman who, according to the custom in all other countries, should keep house for him. The man's mother manages the house, and after her death his eldest sister takes her place; but no man has any idea who his father is, and the children of his sisters are his heirs. Moveable property is divided amongst the children of the sisters of the deceased equally, and the land is managed by the eldest male of the family, but each individual has a right to a share in the income.

This strange custom gives the women an important position; and as they are pretty, and take pains with their personal appearance, their influence is very great. The Nairs are addicted to drink, and may eat venison, fowls, and fish; and the families are fond of gaiety, and of visiting among people of their own rank, when there is much talking and singing. Most of the men, as well as the women, read and write in their own character, and there is a Government Gazette printed in the Malayalim language. The Collector was anxious, also, to establish a paper in Malayalim, containing general information, which would no doubt have an excellent effect, but the difficulty is to find a good native editor.

Next in rank to the Nairs come the *Tiars* or *Shanars*, a stout, good-looking, hard-working race, who do not pretend to Sudra origin. Formerly the Nairs exacted deference from the Tiars with extreme cruelty and arrogance, treating them more like brutes than men; and if a Tiar defiled a Nair by touching him, he was instantly cut down. But British rule is gradually uprooting these caste barbarisms, and the position of the Tiars is improving. Some of them hold appointments as clerks in Government offices, and they are protected by just and equal laws. The Tiars form the mass of the field labourers; but the proper duty of their caste is to extract juice from the palm-tree, and either boil it into *jaggery* (unrefined sugar), or distil it. Their women are exceedingly pretty, with masses of long hair; but there is a prevalent custom for all the brothers of a family to have but one wife amongst them to save expense, which leads to most

disastrous consequences. Below the Tiars there are several outcast tribes; among them the *Churmas* or slaves, a miserable and down-trodden race, possibly the remnant of the aboriginal inhabitants. Even now they are slow to understand that they are not slaves, and land on which there are most *Churmas* still sells at the highest price.

The *Moplahs*, or Mohammedans of Malabar, are descended from Arab mariners and traders by native women, and hence their name, from *Mah-pilla* "son of the mother." They have certainly been established in Malabar for a thousand years, if not more, as it is on record that the Viceroy Cheruman Permal, who then divided the country amongst his chiefs, was converted by a Moplah, and sailed for Mecca. All the sympathies of the Moplahs are with Arabia and the Red Sea, and they frequently undertake pilgrimages to Mecca. Respecting their creed they are fanatical, and are easily roused to fury by an insult, or an attempt on the part of the Nairs to treat them as a lower caste. On these occasions they run mucks; but in ordinary times they are hard-working, intelligent, abstemious, excellent boatmen, and capital backwoodsmen. Many of the Moplahs are very wealthy. Their mosques, however, are poor edifices, not to be distinguished from ordinary dwelling-houses, and the temples of the Hindus are no better. There is no attempt at ornamental architecture in the religious buildings of Malabar.

One-fifth of the collectorate of Malabar is taken up with rice and garden cultivation, the remaining four-fifths being covered with forest, or cleared for dry grains and coffee plantations. The land revenue, taking the average of five years ending in 1858-59, is 255,000*l.* The assessment of the rice-lands is essentially the same as that fixed by the Government of Tippoo Sultan of Mysore in 1783-84. Though unequal, and in some places burdensome, it is on the whole light, and, except in two of the Talooks,[392] it is lighter in the north than in the south. As an example of the inequality of the land-tax, I may mention that the district of Pattaumby, on the river Ponany, is very highly and unfairly assessed, as it is said, from the following cause. Before the invasion of Tippoo all the land in Malabar was in the hands of feudal chiefs; there was no land-tax, and the Zamorin and other Rajahs were supported by the produce of their own estates. The first ruler who imposed a land-tax was the Mysore conqueror. Any village which offended his officers was highly assessed; and hence the present inequalities, which will, however, be corrected by the new Survey and Assessment Commission. In the case of Pattaumby the accountant quarrelled with the landowners, and threatened to impose a heavy assessment, and, when they attempted to murder him, he escaped to Wynaad, and sent in his report to Tippoo.

All land in Malabar is private property, and the landlord gets 20 to 40 per cent. of the net rent, the remainder being the Government demand. From the gross produce of the rice-fields 20 per cent. is deducted for reaping and other small charges called *puddum*, the remainder being available gross rent. From the gross rent one-third is deducted as the expense of cultivation, called *vitoo vally*; one third as the cultivator's share, or

koshoo labon, whether he be a *jemakar* or proprietor, a *kanomkar* or mortgagee, or a *pattamkar* or renter; and the remaining third is the *pattom*, net produce, or rent. Of this last third the Government share is 65 per cent., leaving 35 per cent. as the share of the proprietor. The Government share is thus a little less than a quarter of the gross produce.

The assessment is not calculated on the extent of land, but on the amount of seed required to sow a given space, according to the quality of the soil, which is divided into three classes, namely *pasma* (clay), *rasee pasma* (sand and clay), and *rasee* (sand). On an average the soil does not yield more than tenfold, and most of it bears only one crop. Some lands are sown in April or May, and the crops cut in August or September. These are chiefly in the coast Talooks. Others are sown in September and October, and the crops cut in January and February. The seeds are raised on small pieces of land, and the plants, when young, removed by hand, and planted in the paddy-fields.

The garden assessment, as it is called, on cocoanut-trees, the great wealth of Malabar, betel-palms, and jacks, was fixed in 1820.

The cocoanut-trees are divided according to their situations and soils into five classes —the first and second classes being *attivepoo*, or sea-coast; and the third, fourth, and fifth, *karavepoo*, or inland cocoanut-trees. Each tree pays, on an average, eighteen pies, [393] those which are unproductive from age or youth being excluded. The betel-nut palms pay, on an average, six pies, and the jack-trees twenty-eight pies; but the tax on gardens is not more than forty per cent. of the landlord's rent. A cocoanut-tree is estimated to bear at least sixteen to forty nuts in the year, according to its site; and the owner of a plantation derives profit from the leaves as well as from the husks and shells of the nut. The leaves, used for covering houses, sell at two and a half to five Rs. the thousand, each tree yielding ten to fifteen annually; and the husks, for coir ropes, fetch six annas the thousand.[394]

The betel-nut palm (*Areca catechu*), which is also taxed has a long slender smooth stem, and graceful curving fronds. I have seen palm-trees in the South Sea islands, many kinds in the forests of South America, and in India; but, of the whole tribe, the betel-nut palm is certainly the most elegant and beautiful. Dr. Hooker likens it "to an arrow shot from heaven, raising its graceful head and feathery crown in luxuriance and beauty above the verdant slopes." A tree will produce 300 nuts in the year, and continues to bear for twenty-five years. The nut is very hard, the size of a cherry, and is chewed by all the natives of India with the leaves of the betel-pepper (*Chavica betel*) spread with *chunam*. It is cut into long narrow pieces, and rolled up in the leaves of the betel-pepper or pawn. It makes the mouth and teeth red, and gives the chewer a disgusting appearance. The consumption must be enormous, for it is chewed by 50,000,000 of men, and, next to tobacco, is the most extensively used narcotic; but it has none of the excellent properties of the coca-leaf of the Peruvians.

The jack (*Artocarpus integrifolius*), the only other tree which is taxed in Malabar, grows to a considerable size, and the wood is much used for furniture of all kinds. The fruit, a favourite article of food, is of enormous dimensions, and grows out of the trunk. In Travancore they put the whole fruit in the ground, and, when the young shoots grow up, the stems are tied together with straw, and by degrees they form one stem, bearing fruit in six or seven years.[395] Besides the taxed trees, the gardens round Calicut generally contain mangos and nux vomica.

In addition to the rice or wet cultivation, and the above-mentioned trees, the upland or dry cultivation of rice and sesame or gingelee oil-seed is assessed on an annual inspection: forty per cent. of the gross produce of the former being deducted, on account of the peculiar labour and probable loss, and twenty per cent. of the remainder being the Government share. The sesame cultivation has no deduction from the gross produce; and ginger, pepper, and some other dry crops are free of land-tax. The pepper cultivation is chiefly carried on in northern Malabar, and ginger in the Shernaad district, south of Calicut, by the Moplahs.[396]

The other taxes are *abkarry*, or the privilege of selling liquors, which is either farmed by public sale, or levied from the toddy-drawers, when it is called *kutty-chatty* (knife and pot) tax; *mohturfa* on houses, shops, fishing-boats, oil-mills, and looms; licences, stamps, and the salt monopoly; the whole revenue of Malabar in 1859 having been 266,860*l*. The income-tax had not yet been levied at the time of our visit, but its nature had been carefully explained to the people, it had been stripped of everything that was offensive or inquisitorial, and no difficulty was anticipated in its introduction, although it was very generally considered that it was unwise and impolitic, and that it would be unproductive. In the matter of taxes there was a striking contrast between Peru, whence we had just come, and where they are scarcely known, and this land of manifold imposts.

On the whole, however, Malabar is a splendid possession; the people are very flourishing, the population increasing, and cultivation rapidly encroaching on the forests. There is no gang robbery, but occasional housebreaking, and a good many murders, often caused by jealousy, the criminals usually making a full confession, and thus saving much trouble.

In the evening we embarked in a canoe which had been prepared for us near the fine timber bridge over the Calicut river, on the road to Beypoor. The setting sun and banks of rosy clouds were visible through the graceful fronds of the cocoanut-trees as we drove along the shady road, with occasional glimpses of the sea. The canoe was very long, and cut out of one trunk, with raised bow and stern, ornamentally carved. It was pulled by four tall wiry-looking Moplahs, with nothing on but clouts and huge umbrella-hats, made of the tallipot palm;[397] and a fifth steered with a paddle. Their oars were long bamboos, with circular boards fastened to one end by neat coir seizings. We

started a little after sunset, and passed from the Calicut river by a backwater into the Beypoor, where there were many shallow places, and the Moplahs had constantly to jump out and drag the canoe over them. The banks of the river are wooded down to the water's edge, with groves of slender betel-nut palms rising aloft, and standing out against the starry sky. The foliage was covered with brilliant fire-flies, and here and there we passed a hut, with its owner standing on the shore, waving a burning brand. All night the boatmen sang noisy glees, and in the morning we reached the landing-place at Eddiwanna, forty miles from Calicut, and near the Government teak plantations of Nellamboor.

These plantations were originated by Mr. Conolly, the late Collector of Malabar, with a view to the establishment of nurseries for replenishing the teak forests, as nearly all the fine timber had been felled many years ago. There is a great deal in North Canara of small size, and still more in Cochin and Travancore; but the reckless system of felling threatened the same results as has already overtaken the supply of chinchona-bark in South America. The only forests containing teak, in Malabar, in which Government has a proprietary right, are 25 square miles in the Palghat talook, where all the mature trees have long since gone to the Bombay dockyard; but in 1842 leases of forest-land were obtained from the Zamorin for the cultivation of teak, 70 to 80 square miles in extent, chiefly in the Ernaad talook, near Nellamboor. This most important and now successful measure is due to the zeal and perseverance of Mr. Conolly, and there is a good prospect of the stock of teak-timber in these forests being eventually replenished. The trees, however, require a growth of 60 or 80 years to reach a maturity fitting the wood for shipbuilding; but it is then unequalled by any other known timber; it does not injure iron, and is not liable to shrink in width.

It was some time before the method of inducing the teak-seeds to germinate was discovered, and several experiments were tried. In the forests it was observed that the seeds were prepared for growth by losing the hard outer shell through the warmth caused by fires which annually consume the brushwood. Mr. Conolly, therefore, burnt a coating of hay over the ground where the seeds were sown. This trial was unsuccessful, and in 1843 it was found that the best method was to steep the nuts in water for thirty-six hours, then sow them in holes four inches apart, and half an inch under the surface, covering the beds with straw, so as to prevent evaporation, and gently watering them every evening. By following this plan the seeds germinated, and sprouted in from four to eight weeks. In 1844 as many as 50,000 young trees, raised in the adjacent nurseries, were planted, eight feet apart, in the cleared ground near Nellamboor, along the banks of the Beypoor river, which had been cleared of jungle. The seedlings are transplanted from the nursery at the age of three months, and for the first seven or eight years they sprout up very fast, but afterwards they grow slowly. From 1843 to 1859 as many as 1,200,000 trees have been put down, and they are now planted at the rate of 70,000 a year. Much care is required in systematic thinning and pruning, and, for the

superintendence of this important work, an annual visit is paid to the plantations by Mr. McIvor, who is now so ably conducting the chinchona experiment on the Neilgherry hills.

We were met by Mr. McIvor at Eddiwanna, and started for the village of Wundoor, six miles distant, in *munsheels* or hammocks, slung to bamboos with a shade over them, and carried by six men, who kept up unearthly yells the whole time. The road leads through rice-cultivation and groves of betel-nut palms, jacks, and mangos. Wundoor is a pretty village, with an avenue of sumach-trees[398] leading up to the post-house or travellers' bungalow. These post-houses, which are erected by the Government at easy stages along all the roads in India, for the convenience of travellers, are exceedingly comfortable, and render travelling in India as easy and commodious as it is the reverse in Peru and other parts of South America. At Wundoor the first bungalow we had seen put an end to all idea of having to rough it while travelling in India. The building contained several clean rooms, with cane-bottom sofas, arm-chairs, and tables; and outside there was a pleasant verandah, with a glorious view of the Koondah mountains, which it was necessary to ascend on our road to the Neilgherries. A clump of trees, consisting of jacks, mangos, and peepuls, formed a huge arch, through which there was an enchanting landscape of smiling hill and dale, with the dense forest beyond, crowned by the broken outline of the distant mountains.

We set out from Wundoor at daybreak, and passed a house just outside the village, where, a few days before, a tiger had carried off a child before the eyes of its parents. Next day the brute had the temerity to come again and try to force open the door, when a man shot it from the window. For some hours we rode through a country where the jungle alternated with cultivation in open glades, which in their natural state are covered with *Pandanus*, but the people here, as in other parts of Malabar, are fast encroaching on the forest, and converting these glades into paddy-fields. As we approached the foot of the mountains cultivation at last entirely ceased, and the road led through a dense forest of enormous bamboos, teak-trees with their large coarse leaves, black-wood, and other fine timber. At noon we reached the post-house of Sholacul, at the foot of the Sispara ghaut, which leads up to the summit of the Koondahs, a western continuation of the Neilgherries.

The building at Sholacul was surrounded by a very stout pallisade, to protect it from the wild elephants, who strongly object to all encroachments on their domain; and even take the trouble of pulling up the wooden milestones by the side of the roads. We found all the roads which we travelled over in Malabar excellent, and the ascent of the Sispara ghaut, though only a zigzag bridle-path, is in very good order. After leaving Sholacul the road first passes through a region of gigantic reeds, and then through a belt of black-wood, palms, and tree-ferns, with an undergrowth of *Curcumas*, ferns, and a brilliant purple flower (*Torenia Asiatica*). The black or rose-wood tree (*Dalbergia latifolia*)

grows to a height of about fifty feet, with handsome spreading branches, and pinnate leaves. The timber is very valuable; it is extensively used in Bombay for making beautiful carved furniture, and planks are sometimes obtained four feet broad, after the sap-wood has been removed. In consequence of the increasing price, Dr. Cleghorn, the able and energetic Conservator of Forests in the Madras Presidency, has caused a number of seedlings to be planted at Nellamboor; and plantations have also been formed in N. Canara and Mysore.

The occasional openings in the forests, at turns in the road, afforded us views of the mountains below us covered with the richest vegetation, and of the rice-fields of Malabar stretching away to the faintly indicated blending of sea and haze on the horizon; which almost equalled in beauty the finest parts of the eastern Andes. From about 1000 to 5000 feet above the sea the jungle is covered with innumerable leeches, which eagerly fasten on their prey, whether men, horses, or dogs, and make a journey through this region, in the wet season, exceedingly disagreeable. Within this leech-zone there is a considerable clearing called Walla-ghaut, planted with coffee, which is in a ruinous and abandoned state, chiefly owing to the difficulty of inducing labourers to venture among the leeches. As we continued the ascent, the scenery increased in magnificence, the views became more extensive, and there were mountain-tops crowned with glorious forest trees far below us. At 6000 feet mosses appear, then lilies, brambles, and wild strawberries, and occasionally we crossed noisy little streams overshadowed by the trees. We reached the Sispara bungalow, on the summit of the ghaut, 6742 feet above the level of the sea, late in the afternoon.

The Sispara ghaut takes the traveller from the tropical plains to the temperate climate of the hills, where the face of nature is entirely changed. Here the hills are covered with grass, and the ravines only are filled with trees, forming thickets called *sholas*. In the rear of the bungalow there is an almost unrivalled view of the Malabar plains, from the edge of a precipice. The Koondah hills sweep round until they join the Wynaads, half encircling the Nellamboor valley, which was thousands of feet below us, and is covered with forest, intersected in all directions by open glades of a rich light green. The Koondahs rise up from Malabar like perpendicular walls, so steep that even a cat could not scale them in any part, for a distance of forty miles; and the grandeur of the view from this point, with these sublime cliffs, and the vast expanse of forest-covered plain below, is very striking.

At daylight next morning we left the Sispara bungalow, and rode for several miles through a valley interspersed with *sholas* of rhododendron-trees. Eighteen miles from Sispara is the Avalanche bungalow, 6720 feet above the sea, whence there is a good carriage-road to Ootacamund, the chief European station on the Neilgherry hills. At Avalanche the Koondah range is considered to cease, and the Neilgherry hills to commence, but the nature of the country is the same. Between Avalanche and

Ootacamund, a distance of 15 miles, the country consists of grassy undulating rounded hills, divided from each other by wooded *sholas*. Herds of fine buffaloes were grazing by the roadside, and here and there we saw patches of millet (*Setaria Italica*) near the huts of the natives of these hills. As we rode round the artificial lake, and, passing several pretty little houses surrounded by shrubberies, stopped at the door of Dawson's hotel at Ootacamund, it was difficult to persuade ourselves that we were not again in England. The garden in front of the house was stocked with mignonette, wallflowers, and fuchsias, but the immense bushes of heliotrope covered with flowers, ten feet high and at least twenty in circumference, could not have attained such dimensions in an English climate. Ootacamund is nearly in the centre of the table-land of the Neilgherries, at the foot of the western face of the peak of Dodabetta, and, except to the N.W., the station is completely surrounded by grass-covered hills. Houses are scattered about under the shelter of the hills, with gardens and plantations of *Eucalyptus* and *Acacia heterophylla*, trees introduced from Australia, around them; and the broad excellent roads are bordered by *Cassia glauca* bushes with a bright orange flower, honeysuckles, fox-gloves, geraniums, roses, and masses of the tall *Lobelia excelsa*. A graceful white iris is also common.

This charming spot, now that the roads are planted with tall trees, and the hedges filled with all the familiar flowers introduced from old England, while curling smoke ascends through the foliage, and suggests the idea of chimneys and warm firesides, is as unlike India, and as like an English watering-place, as can be imagined. The tower of the church, seen from many points of view, increases the resemblance, which is certainly not lessened by the rosy cheeks and healthy looks of the children, and the fresh invigorating mountain air. But when a few miles from the station, and out of sight of all English associations, there was much that reminded me of the *pajonales* in the chinchona region of Caravaya at a first glance: and I felt sanguine that all the *pajonal* chinchona-trees would thrive in most of the *sholas* on the Neilgherry hills, while suitable sites for those species which require a warmer climate would be found in the forest slopes which overlook the plains. A closer inspection confirmed me in this opinion.

CHAPTER XXII.

NEILGHERRY HILLS.

Extent—Formation—Soil—Climate—Flora—Hill tribes—Todars—Antiquities—Badagas—Koters—Kurumbers—Irulas—English stations—Kotergherry—Ootacamund—Coonoor—Jakatalla—Government gardens at Ootacamund and Kalhutty—Mr. McIvor—Coffee cultivation—Rules for sale of waste lands—Forest conservancy.

The Neilgherry[399] hills, between latitude 11° 10' and 11° 32' N., and longitude 76° 59' and 77° 31' E., form the most elevated mountain mass in India, south of the Himalayas; the highest peak, that of Dodabetta, being 8610 feet above the level of the sea. They are isolated on three sides, and rise up abruptly from the plains of Coimbatore on the south, and from the table-lands of Wynaad and Mysore on the north and east, to a height of 6000 feet above the former, and 2000 to 3000 above the latter; from which they are divided by the broad ravine of the river Moyaar. On the west they are united with the Koondah range, which is a continuation of the western ghauts. The area of the Neilgherries contains 268,494 acres, of which 24,000 are under cultivation.

The formation consists of syenitic granite, with veins of basaltic rock, hornblende, and quartz, while, in some parts, half-decomposed laterite underlies the soil. The plateau is not a flat table-land, but a succession of undulating hills and intervening grassy valleys, with ravines thickly wooded, numerous streams, and occasional rocky ridges running up into fine mountain-peaks. The streams all go to swell the great river Cauvery, by its tributaries the Moyaar and Bowany; the Moyaar descending from the hills by a fine waterfall at Neddiwuttum, on the northern slope; and the Bowany flowing down between the Koondahs and Neilgherries to the south. The soil of the plateau is very rich, being formed by the decomposition of basaltic and hornblende rocks, mixed with the clayey products of the granite, and much decomposed vegetable matter. The latter consists of the grass killed down to the roots by the frost, washed in by the succeeding rains, and mixed with the subsoil, increasing its richness and depth season after season. The richest land is on the lower slopes, where there are accumulations of soil washed from the hills above:[400] and there are extensive deposits of peat in the valleys, which afford supplies of fuel. The chief defect in the soil is the absence of lime.

The temperature and amount of humidity vary according to the locality. At Ootacamund, 7300 feet above the sea, the means of the thermometer range from 42° to 68°, while in the two other lower and warmer stations of Coonoor and Kotergherry, about 6000 feet above the sea, the range is from 52° to 71°. The annual rainfall at Ootacamund is sixty inches, at Coonoor fifty-five inches, and at Kotergherry fifty inches. During the south-

west monsoon, from May to September, the rain comes down in torrents at Sispara, and in the western parts of the Neilgherries, but their force is somewhat exhausted before reaching Ootacamund, in the centre of the plateau. At that station the rainfall, during the south-west monsoon, is about thirty-four inches; and the range of Dodabetta, which rises up like a wall, immediately to the eastward of Ootacamund, almost entirely screens the eastern part of the hills from the rains of the south-west monsoon, and there the rainfall is only twelve inches from May to September. During the portion of the year from October to April the western parts of the hills are comparatively dry, the prevalent winds are from the north-east, and the rains which they bring with them from the Madras coast do not extend farther west than the neighbourhood of Ootacamund. Kotergherry, and the eastern parts of the hills, receive the full benefit of the rains from the north-east monsoon, but they are not heavy, and the rainfall at Kotergherry, in that season, is thirty-eight inches. Ootacamund also gets some of the rain of the north-east monsoon (thirty-six inches), so that, in that central part of the plateau, there is a belt which receives a moderate supply of rain throughout the year. In January and December there are frosts in the night, and the extreme radiation which goes on in the valleys causes great cold at sunrise; but these frosts are confined to the valleys in the upper plateau, and they never visit the higher slopes, or the well-wooded "*sholas*."

The climates of the Neilgherry hills are the most delightful in the world; and it may be said of this salubrious region, with its equable seasons, what the Persian poet said of Kung, "the warmth is not heat, and the coolness is not cold."[401] On the open plateau, in the wooded *sholas*, and in the thick forests of the lower slopes, there is a great variety of beautiful flowering trees and shrubs; and the vegetation of the hills is both varied and luxuriant. First, in the brilliant splendour of its flowers, must be mentioned the tree rhododendron (*Rhododendron arboreum*), which is very common in all parts of the hills, either forming small thickets or dotted about on the grassy slopes. It grows to a height of twenty feet, with a gnarled stunted trunk, and masses of deep crimson flowers. In the "sholas" are the *Michelia nilagiraca*, a large tree, with yellowish-white fragrant flowers of great size; the *Symplocos pulchra*, with hairy leaves and snow-white flowers; the *Ilex Wightiana*, a large umbrageous tree, with small white flowers and red berries; the pretty pink-flowered *Rhodo-myrtus tomentosa*, the berries of which are called "hill gooseberries;" the *Jasminum revolutum*, a shrub with sweet yellow flowers; the *Sapota elingoides*, a fine forest-tree, with rough cracked bark, and an edible fruit used in curries; *Crotalariæ*; *Bignoniæ*; peppers, cinnamon, a number of chinchonaceous shrubs, and many others.

In the open grassy slopes and near the edges of the wooded ravines are several *Vaccinia*, especially the *Vaccinium Leschenaultii*, a shrub with pretty rose-coloured flowers; the beautiful *Osbeckia Gardneriana*, with a profusion of large purple flowers; the handsome *Viburnum Wightianum*; a number of balsams (*Impatiens* of several species); the *Gaultheria Leschenaultii* in great quantities, a pretty little shrub with

white flowers and blue berries; the *Berberis Mahonia*, with its glossy prickly leaves and long slender racemes of yellow flowers; and the bright little pink *Indigofera pulchella*; while the climbing passion-flower (*Passiflora Leschenaultii*) hangs in festoons over the trees, especially in the eastern parts of the hills. Among the more inconspicuous plants are the *Gallium requienianum*; the *Rubia cordifolia*;[402] the thorny *Solanum ferox*, with stem and leaves covered with strong straight prickles; the *Girardinia Leschenaultii*,[403] or Neilgherry nettle, a most virulent stinger; the tall *Lobelia excelsa*; a *Justitia*, with a blue flower, which entirely covers some of the hills; some pretty *Sonerilas*; several beautiful *Ipomœas* and *lilies; elsias*; and the *Hypericum Hookerianum*, growing plentifully in the meadows, with large orange flowers; besides ferns, lycopods, and numberless small wild flowers in the grass and underwood.

Enjoying a delightful climate, well supplied with water, and with its gentle undulations of hill and dale in some places clothed with rich pasture, in others presenting woods of fine timber and beautiful flowering shrubs, the Neilgherry hills are eminently fitted for the abode of a thriving and civilized people. Yet for many centuries it would appear that their sole inhabitants were a strange race of cowherds, a people differing in all respects from their neighbours in the plains, and indeed from all the other natives of Hindostan.

These are the Todars, a race numbering less than a thousand souls, who now claim to be the original "Lords of the hills." In times so remote that no record of them remains there are still indications that the Indian peninsula was peopled by races of Scythic origin: and, when the Aryan warriors came forth with their Vedic hymns and grand old civilization from the fastnesses of Sind, they swept irresistibly over Hindostan, and formed as it were an upper stratum of the population. The Scythic element either mixed with, or became subservient to the Aryan in the plains, as the Sudra caste, while in the hill and forest fastnesses a few tribes remained isolated and independent. Such, possibly, may have been the origin of the Todars on the Neilgherries. The Brahmins, characteristically dovetailing every tradition and every race into one or other of their historical myths, declare that the Todars came from the north in the army of Rama, when he marched against the wicked Ravana; and that, deserting their chief, they fled to these hills. They themselves have no tradition of their origin, but believe that they were created on the hills.

They are certainly a very remarkable and interesting people, tall, well-proportioned, and athletic, and utterly unlike all other natives of India. They have Jewish features, with aquiline noses, hazel eyes, thick lips, bushy black beards, and immensely thick clusters of glossy hair cut so as to stand in dense masses round the sides of the head, a very necessary protection from the sun, as they never wear any other head-covering. The old men are very handsome, with long white beards and upright gait, looking like the patriarchs of the Old Testament, with their strongly marked Jewish features: but the expressions of the younger men are less agreeable to look upon. The women are very

careful of their hair, which hangs down in long glossy ringlets; and both sexes wear nothing but a long piece of coarse cotton cloth, with two broad red stripes round the edges, worn by the men like a Roman toga, which sets off their well-shaped limbs to advantage, and exposes one leg entirely, up to the hip; and by the women so as to form a short petticoat and mantle. They never wash either their persons or their clothes from the day of their birth to the day of their death. They live in small encampments called *munds*, which are scattered over the hills, and consist of five or six huts, and a larger one used as a dairy. The families are in the habit of migrating from one *mund* to another, at certain seasons of the year; so that we often came upon a *mund* apparently abandoned. A Todar's hut is exactly like the tilt of a waggon, very neatly roofed, with the ends boarded in, and a single low entrance. They are generally surrounded by a stone wall, and the dairy, a larger and more important building, is always a little apart. The only occupation of this singular people is to tend their large herds of fine buffaloes; they live on milk, and on the grain which they collect as a due or *goodoo* from the other hill tribes, and pass the greater part of their time in idleness; lolling about and gossiping in their munds, or strolling over the hills. We passed through one of these munds, about a quarter of a mile from our hotel, almost daily, but I never remember having seen a Todar engaged in any occupation whatever.

The women become the wives of all the brothers into whose families they marry, the children being apportioned to husbands according to seniority. This pernicious custom is also common among the Coorg, and the Tiars of Malabar. The Todars, formerly, only allowed one female child to live in each family, the rest being strangled; but the authorities have lately interfered to put a stop to this custom. When a Todar bride is given away, she is brought to the dwelling of her husbands, who each put their feet upon her head; she is then sent to fetch water for cooking, and the ceremony is considered to be complete.

The German missionaries, who have had a good deal of intercourse with these people, say that they worship the "sacred buffalo bell," as a representation of *Hiridea*, or the chief God, before which they pour libations of milk; and when there is a dispute about wives or buffaloes it is decided by the priest, who becomes possessed by the *Bell God*, rushes frantically about, and pronounces in favour of the richest. Formerly there were seven holy *munds*, each inhabited by a recluse called *palaul* (milkman), attended upon by a *kavilaul* (herdsman); but three of these are now deserted, and the fourth is rarely frequented. The rest have a herd of holy buffaloes attached to them for the use of the sanctified occupants, and no women may approach them. The only religious festival of any kind celebrated by the Todars, and that scarcely deserves the name, takes place on the occasion of a funeral, when there is much dancing and music. The body is burnt, and buffaloes are slaughtered to go with the spirit, and supply it with milk. This is called the green funeral. A year afterwards there is another ceremony called the dry funeral, when forty or fifty buffaloes were hunted down, and beaten to death with clubs; but the

Government has recently prohibited the immolation of more than two beasts for a rich, and one for a poor Todar. The burial-places are like gigantic extinguishers, twelve feet high, and thatched with grass. The bodies are burnt, and the ashes collected and put into chatties, which are deposited in the extinguisher. The Todars have no other ceremonies, care for nothing but their buffaloes, and leave prayers to the *palaul* in his lonely retreat, or to the *palikarpal* or dairyman of each mund, who covers his nose with his thumb when he enters the sacred dairy, and says "May all be well!"[404]

The Todar language is a very rude dialect of the old Canarese, and similar to that of the Badagas, another hill tribe. It is very poor in words conveying abstract ideas, as they have few notions beyond their buffaloes; their verbs have generally but one tense, and they express the future and past by means of adverbs of time.[405]

There are many ancient cairns and *tumuli* on the peaks of the Neilgherries, and it has been objected that they cannot be assigned to the ancestors of the Todars, because agricultural implements have been found in them, and these people never cultivate the ground. But it must be remembered that the Todars now extort *goodoo* or tribute of grain from the other hill tribes, and that it is their only food. It must be inferred, therefore, that, before they discovered this easy mode of procuring food, and previous to the arrival of these weaker agricultural tribes on the hills, the Todars must have been their own cultivators. The hill people attribute all ancient ruins, of the origin of which they know nothing, to the Pandus, the famous heroes of Hindu tradition; and all that can be said of these Neilgherry cairns is that they are probably the work of an unknown extinct race, who practised Druidical rites.[406]

We visited several of these remains of an ancient people. On the summit of the peak of Kalhutty, on the left hand of the road leading down the Seegoor ghaut to the Mysore plains, whence there is a grand view of mountain scenery, forest-clad slopes, and a wide expanse of country stretching away to the horizon, we found several old cairns. They were of great size, built of immense stones, and hollow in the centre. On another peak, called Ibex Hill, one side of which is a scarped cliff many hundreds of feet in height, overhanging the Seegoor ghaut, we also found two huge cairns, forming a circle about eight feet in diameter. There are many others in different parts of the hills, generally on the highest peaks, and iron spear-heads, bells, sepulchral urns with figures of coiled snakes, tigers, elephants, dogs, and birds on them, sickles and gold rings have been found buried under the piles of stones.

The Todars, as has been said, are the "lords of the hills," and not only all the other hill tribes pay them tribute, but the English Government also pays rent to them for the land on which the stations are situated.[407] But the agricultural tribe of Burghers or Badagas, who came to the hills several centuries after the Todars, and are subject to them, are by far the most numerous, numbering 15,000 souls, and occupying 300 villages. They are

divided into eighteen classes or castes, the members of one of which, called the Wodearu Badagas, wear the Brahminical string, are proud and lazy, and inhabit five villages apart from the rest. The villages of the Badagas are scattered all over the plateau of the hills, and their land occupies two-thirds of its area. They are much darker, and not nearly such fine men as the Todars, wear cotton-cloth turbans and clothing much like other natives of India, and are very superstitious and timid; but they are industrious, though not so much so as the labourers who come up from the plains, and kind and affectionate to their women and children. The Badagas, though they possess herds of buffaloes, are chiefly employed in cultivation. Their crops consist of *raggee* (*Eleusine corocana*), the most prolific of cultivated grasses,[408] which is made into dark brown cakes and porridge; *samee* or Italian millet, barley, an amaranth called *keeray*, some pulses, mustard, onions, and potatoes. We often passed through the Badaga villages. The houses are built in a single row, with one thatched roof extending over so as to form a verandah, supported on poles. In front there is a hard mud floor, where the piles of grain are heaped up; and there is generally a *Swami*-house or temple, with a verandah in front supported by numerous poles, the walls and poles being painted in red and white stripes, the Hindu holy colour. Round the villages there are cultivated patches of *raggee* and *samee*, which they were reaping in December. In the centre of the fields there is a small threshing-floor, where we often saw the Badagas sifting the grain from the chaff by shaking it through sieves, and letting the wind blow the chaff away. A Todar was generally squatting near, like an old vulture, waiting for his *goodoo*. The Badagas belong to the Siva sect, their principal deity being Rungaswamy, whose temple is on the summit of the easternmost peak of the Neilgherries; but they also worship 338 other idols or *Swamis*, such as trees, streams, stone pillars, and even old knives.

Another hill tribe is that of the Koters, who occupy seven large villages called *Kotergherry* (cowkiller's hill). They are of very low caste, and work as carpenters, smiths, rope-makers, and potters, besides cultivating the ground. The Koters also dress and prepare buffalo-hides, and they are a squalid dirty race, living on the carrion they pick up on the road-sides. They number about five hundred souls, and are the artizans of the hills, repairing the ploughs, hoes, and bill-hooks for the Badagas.

The Kurumbers, another tribe, live on the slopes of the hills, in the most feverish places. They are a short miserable-looking race, and those called *Mooloo* or jungle Kurumbers are regular wild men of the woods, in no respect raised above the beasts of the forest. The others act as musicians and sorcerers to the Todars and Badagas.

Lastly, the Irulas live low down the slopes of the hills, perform the office of priests in the Badagas' temple on the Rungaswamy peak, and occasionally act plays from the life of Krishna at Badaga festivals.

These five tribes of Todars, Badagas, Koters, Kurumbers, and Irulas, appear for centuries to have had the exclusive enjoyment of the Neilgherry hills; though Tippoo

Sultan of Mysore erected a fort at Kalhutty, half-way up the Seegoor ghaut, and another on the Hoolicul-droog, overhanging the Coonoor ghaut, which leads up from the Coimbatore plains. He is said to have used these strongholds for the detention of prisoners, and to enable his officers to extort tribute from the hill tribes. The Neilgherry hills were first discovered by two English civilians who made their way up to the plateau in chasing some Moplah smugglers.[409]

In 1820 Mr. John Sullivan, then Collector of Coimbatore, built the first house in Ootacamund, on the site of a Todar mund of the same name.[410] It is now used as the building for the Lawrence Asylum. The first sanatarium on the hills, however, was at Dimhutty, on the eastern side, and at the adjoining station of Kotergherry, but the former is now abandoned. The delightful climate soon attracted crowds of visitors from the burning plains; many houses gradually rose up on the grassy slopes round the lake which was formed at Ootacamund by bunding up one end of the valley, and the place rapidly became an important hill-station. A small native town and bazaar sprang up on the banks of the lake, a handsome church was erected, a club-house, and, most conspicuous of all, an immense Parsee shop kept by Framjee Nusserwanjee of Bombay. The roads are excellent, and planted with tall graceful Acacia and gum-trees from Australia, and many of the houses are surrounded by beautiful gardens and shrubberies. The most charming, perhaps, is that of the late Bishop Dealtry, called Bishops-down, whence there is a glorious view of the station on one side, and of the distant Koondah hills, overtopped by the sharp peak of Makoorty, on the other. Advantage has here been taken of a wooded *shola* to make pleasant shady walks, and cut vistas through the trees.

The warmer station of Coonoor is about nine miles from Ootacamund, at the head of the ghaut which leads down to the plains of Coimbatore. Here the scenery is far more beautiful than at the central station, as the wooded sides of the ghaut run up into a fine peak called the Hoolicul-droog, and the view extends far away over the plains. The houses are perched on the rounded tops of a range of hills, and there is a church with a fine tower, which is a great addition to the view of Coonoor from the surrounding eminences. A mile from Coonoor, in the direction of Ootacamund, is the military station of Jakatalla, the finest barracks I ever saw in any part of the world. It is well sheltered by high hills from the cold north winds to which Ootacamund is exposed, as well as from the south-west monsoon, and is in every respect admirably adapted as a sanatarium for soldiers and their families. It has been maintained that the children of Europeans cannot be reared even on the hills of India, though upon what grounds this extraordinary assertion is based I have not yet learnt. The strongest arguments against this idea are the fresh rosy cheeks and rude health of the boys and girls in the Lawrence asylum, and of the boys and young men at Mr. Pope's[411] and Mr. Nash's schools in Ootacamund, who present a striking contrast to the children on the plains. The bracing climate of the upper plateau of these hills appears to me to be perfectly well adapted for

European colonists: it has all the advantages with none of the disadvantages of England, and there are no influences which can be detrimental to English constitutions. At the time of our visit a battalion of the 60th Rifles, and a number of convalescent soldiers from other regiments, were stationed at Jakatalla. The quarters for the men are built round a large quadrangle, with an upper story, and airy corridors for exercise in wet weather. Beyond are the married quarters for ninety couples, each with two comfortable rooms and a little garden; and there are also a hospital, library, schoolrooms, substantially-built skittle-alley with brick arches, fives-court, and swimming-bath. The officers are quartered in bungalows on the surrounding hill-slopes, or at Coonoor. It would be well if the whole of the European troops in the Madras Presidency were permanently quartered on the Neilgherry and other hills as soon as the railroads are completed. Many of the married men might be permitted to cultivate and settle on land of their own, with their families, subject to the condition of being liable to be called on to serve if required, and a sort of military colony might thus be formed. There is excellent pasture for flocks of sheep, wheat may be grown in any quantity, and there is not the slightest danger to Europeans in undertaking field labour.

The English settler on the Neilgherries will find English fruits, flowers, vegetables, and grasses, the introduction of which is mainly due to the exertions of Mr. William G. McIvor, the Superintendent of the Government gardens at Ootacamund, and now also Superintendent of Chinchona plantations in Southern India. This gentleman has been in charge of the gardens at Ootacamund since 1848, and unites zeal, intelligence, and skill to the talent and experience of an excellent practical gardener. Under his auspices the steep slopes of one of the spurs, which run off from the peak of Dodabetta, and overlook the cantonment of Ootacamund, have been converted into a tastefully laid-out garden, in a succession of terraces. Hampered at first by the interference of a useless committee, and with no assistance beyond that of an East Indian foreman and labourers from the Mysore plains, he has succeeded in changing the wild mountain-sides into a very beautiful public garden. Every point of view is taken advantage of with admirable taste, and numerous trees and flowering shrubs have been introduced from England, Australia, and other countries, while the native flora of the hills is fully represented. There are English roses and geraniums, ponds bordered by white arums, shady walks over-arched by trellis-work, tasteful vases filled with showy flowers, thickets of rhododendrons, hedges of heliotrope and fuchsia, fine clumps of tall spreading trees, and, from the upper terraces, between the leafy branches, there are glorious views of the Ootacamund valley, and of the finely broken range of the distant Koondah hills.

Mr. McIvor also has a small branch-garden at Kalhutty, about half-way down the Seegoor ghaut, leading to the Mysore plains, for raising fruits which require a warmer climate. This garden is self-supporting. A magnificent waterfall descends into a rocky basin close beside it, and the garden contains oranges of many kinds, shaddocks, lemons, limes, citrons, nutmegs, loquats, and plantains. On this spot the delicious

chirimoyas, the seeds of which we brought from Peru, will hereafter ripen, and enable the people of India to taste the "masterpiece of nature."

European enterprise on the Neilgherries has hitherto been chiefly directed towards the cultivation of coffee, and there are several fine estates near Coonoor. On the 15th of November we set out from Ootacamund to visit them, and rode down the valley of Kaitee, where the house stands which once belonged to Lord Elphinstone, certainly not in a well-selected spot. It was originally chosen for a Government farm, which was given up, and the house was then occupied for a short time by the Governor of Pondicherry. Lord Elphinstone, when Governor of Madras, took a fancy to the place, erected a very substantial house, finished it handsomely, and frequently resided there. In 1845 the property was bought by Mr. Casamajor of the Civil Service, who established a school there for Badaga children, on the principle of paying them for coming, at the rate of 1 anna a day. On his death he left it to the Basle Evangelical Missionaries, by whom it is now occupied. They have schools, and labour amongst the Badagas, but as yet with scarcely any success.

The stream which drains the Kaitee valley forms a very beautiful waterfall down the face of a cliff into the Karteri valley, where there is a small coffee estate worked by a Frenchman; and, after crossing a range of hills, in parts thickly wooded, and in parts covered with a shrubby *Justitia* with a blue flower, we reached the coffee plantation of Hoolicul,[412] owned by Mr. Stainbank. The highest part of his estate is 5700 feet above the sea,[413] and here he has twenty-five acres planted in rather poor soil. Below his house there are about forty-five more acres planted, down the steep slopes of the hill, some of the bushes in very good bearing. They are thick, as he is against pruning the branches, saying that when covered by leafy branches the fruit ripens by degrees, and consequently requires less labour in picking. The estate has passed through several hands, and the oldest trees were planted seventeen years ago. Mr. Stainbank expects eventually to get fifty tons of coffee off this estate, in the year. An acre will occasionally yield twenty-five hundredweight.

The view from the house is very fine. The plantation slopes away by a very steep descent, and in the distance are the Lambton's Peak range of mountains, and the wide plains of Coimbatore.

Leaving Hoolicul, we again descended into the ravine of Karteri, where the river passes close under the steep face of the hills on which the station of Coonoor stands, and on the slopes of the opposite mountains there are several coffee estates. Mr. Dawson, a son of the landlord of the hotel at Ootacamund, has 100 acres planted; but the most extensive estate, on the steep slopes overlooking the ghaut leading down into the Coimbatore plains, belongs to Mr. Stanes. He has 200 acres planted with 250,000 trees, up the precipitous sides of the mountain, facing east, and protected from the excessive rains of the S.W. monsoon. The elevation above the sea is upwards of 4800 feet. On the

summits of the mountains above this estate Mr. Stanes has induced the Todars to form two cattle crawls, whence manure is washed down to his plantation. The trees are planted in rows, 6 to 8 feet apart, and regularly topped and pruned, so as to admit the sun to ripen the fruit on every branch. They are from 4 to 6 feet high, and planted in holes 20 inches deep by 18; the young plants being brought from a nursery, where seedlings are raised. The trees are generally in full bearing in the third year. After the berries are picked, and brought in baskets to the *godown* or warehouse, the pulp or fleshy part has to be removed. The berries are placed in heaps in a loft, above the *pulper*, looking bright and red like ripe cherries. They are then sent down a shoot, into which a stream of water is conducted, and are thus washed into the pulper. On Mr. Stanes's estate this machine is worked by a water-wheel, but generally it is turned by hand and a fly-wheel. The pulper is a roller covered with a sheet of copper, made rough like a nutmeg-grater. The berries fall on it as it goes round, but there is only room for the seed to pass, so that the pulp is squeezed off, and carried away by a stream thrown off by the water-wheel, while the naked coffee drops on the other side. The seeds are still covered with glutinous matter, to remove which they are well washed in a cistern, the inferior ones floating, while the good ones sink. The coffee-seeds are then laid out on the *barbecus*, square platforms of brick plastered with *chunam*, with sides a foot high; where they dry in the sun for about three days, and are afterwards stored in the godowns.

It is estimated that an acre of jungle on the Neilgherries may be cleared for 200 Rs., including all expenses. The coffee-seedlings, from the nursery, may be planted out in seven months, and they will yield a first crop in three years. Coffee-seeds are 5 Rs. a bushel, and that quantity will rear 10,000 plants, covering 10 acres. One acre ought to yield one ton, when well cultivated, selling at Calicut, uncleaned, for 4 annas the pound. In three years the estate ought to pay 10 per cent. on the capital expended, if well conducted; the next year the gross profit should increase to 60 per cent., and afterwards to 100 per cent. A good dwelling-house will cost 4000 Rs.; the pulping-house, machinery, and godowns, 4000 Rs. more. Carpenters get 20 Rs. a month, bricklayers 15 Rs., with 2 annas a day batta for coming out of the town, and common labourers 4½ Rs.

The Neilgherry planters have great advantages in the way of means of conveyance from their estates to Calicut and Beypoor, their ports of shipment. The coffee is carried down the Coonoor ghaut on pack-bullocks to Matepoliem, and thence in carts along a good road, by Palghatchery, to the sea-coast. Generally the coffee from the Neilgherry estates is bought by Mr. Perry and Mr. Andrews at Calicut, in rather a dirty state. They have garbling-machines for clearing away all remaining dry pulp, and removing the outer coat from the seeds; and they make their profit by shipping the coffee and selling it in a clean state fit for European use. Neilgherry coffee has an excellent name in the London market.

Europeans, on the Neilgherries, hold land by a *puttum* or grant from Government, leasing it in perpetuity, so long as the assessment is paid, which is fixed at 1 R. per acre of coffee-land, levied after the third year. By the resolution of the Madras Government, dated August 5th, 1859, the terms on which waste lands can be purchased were regulated. These orders apply to all the regions in Southern India which are suited for coffee or chinchona cultivation. It was resolved to sell outright the fee-simple of all land used for building, and of waste land in the hills, without reservation of quit-rent, and with an absolute and indefeasible title, sold to the highest bidder at an upset price, at twenty times the amount of yearly quit-rent or land-tax. A title-deed will be given under the seal of the Government, declaring the absolute title of the holder, free from all demands on account of land-revenue, with full powers to dispose of the land at pleasure, but not exempting it from payments for municipal purposes. Other parties, however, claiming a previous right in the land, will be free to sue the holder in the Civil Courts, up to a certain time, so that it will be necessary to make careful investigations on this point before purchasing. When the land-tax is not redeemed, Government will issue permanent title-deeds, reserving a quit-rent, and the holder will be free to redeem the tax, on the same terms, at any future time.

With regard to labour on the Neilgherries, there used to be abundant supplies of coolies from Mysore and Coimbatore, but they have recently fallen off, owing to competition on the railway works. Mr. Stanes was paying his labourers 4½ Rs. a month, and women 3½ Rs. He told me that he was particular always to pay every labourer himself, and to be very kind to them, by which means he never found any difficulty in procuring labour. Some of the planters get the services of Badagas, and even of some Kurumbers in the picking-time, but the hill tribes are not generally willing to work on the coffee plantations. There are fifteen coffee estates on the Neilgherry hills.

But the oldest coffee-district in Southern India is Wynaad, a forest-covered plateau about 3000 feet above the sea, which adjoins the Neilgherries on the north. In this district there are upwards of thirty coffee-plantations, some of them, such as that of Messrs. Campbell and Ouchterlony, near the ascent to the Neilgherry hills, being very extensive.[414] There is a great rainfall in Wynaad during the S.W. monsoon, and the crops are very abundant; but at the same time the coffee is not so good as that grown in drier situations, such as the Neilgherries near Coonoor, though the yield is greater. Most of the available land is already taken up. The labour is derived from Mysore, whence the coolies come, often from distances of sixty or seventy miles, returning to their families when their wages are paid. In 1860 the tax on coffee-estates in Wynaad was fixed at 2 Rs. an acre on land actually planted, to be imposed in the third year, at which time the trees are in bearing.[415]

The export trade in coffee, from all the hill-districts of Southern India, was, in 1859-60, as follows:—

	Quantity.	Value.
From the ports of Malabar	7,35,19,26 lbs.	7,35,177 Rs
From the ports of Canara	5,13,36,35	8,66,644
From the ports of Tinnevelly	23,36,93	23,387
From the port of Madras	8,15,89,74	2,49,846
	20,87,82,28	18,75,054

In connexion with the clearing of forests for coffee-cultivation, it is imperative that due attention should be paid to the preservation of valuable timber, and the conservancy of the belts of wood near the sources and along the upper courses of streams, so as to ensure the usual supplies of water, and to retain a due amount of moisture in the atmosphere. For the superintendence of these important measures, together with other duties, Dr. Cleghorn has been placed at the head of a Forest Conservancy Department in the Madras Presidency. He strongly urges that the high wooded mountain-tops overhanging the low country should not be allowed to be cleared for coffee-cultivation, lest the supplies of water should be injured.[416] "The courses of rivulets," he says, "should be overshadowed with trees, and the hills should therefore be left clothed for a distance of half their height from the top, leaving half the slopes and all the valleys for cultivation. Immense tracts of virgin forest in the valleys of the Koondah hills are eminently suited for coffee-cultivation. The clearing should only be allowed from 2500 to 4500 feet, this being the extreme range within which coffee planted on a large scale is found to thrive."

There are still thousands of acres of uncleared forests, at suitable elevations, well adapted for the growth of coffee, in the cultivation of which the English capitalist would make large and rapid profits; yet it is not many years since the first coffee-plants were introduced into these hills. Coffee now forms an important item in the exports from the Madras Presidency. There is every reason to hope that the bark from quinine-yielding chinchona-trees may also become one of the valuable products of the hills; and in the following chapter I propose to give an account of the selection of the sites for the first experimental plantations.

CHAPTER XXIII.

SELECTION OF SITES FOR CHINCHONA-PLANTATIONS ON THE NEILGHERRY HILLS.

The Dodabetta site—The Neddiwuttum site.

In selecting sites for chinchona plantations in the Neilgherry hills we had to compare the climate and other conditions of growth which prevail in the chinchona forests and open *pajonales* in the Andes with any similar localities which might be found in Southern India. For the first experimental sites, it was of course important that the resemblance, as regards elevation, temperature, and humidity, should be as close as possible; but there was every reason to hope that, under cultivation, these plants, like most others, would adapt themselves to conditions of soil and climate extending over a far more extensive area.

It was necessary to fix upon two sites in the first instance, one at the highest point at which chinchona-plants were likely to flourish, for the species from Loxa and others growing at great elevations, and as an experimental plantation; and another in a lower and warmer position for the plants of *C. succirubra*, *C. Peruviana*, *C. micrantha*, and the tree *C. Calisaya*. The highest point at which these plants will flourish, and the greatest exposure they will bear without injury, are the most favourable conditions for the formation of quinine; while, if the *sholas* in the upper plateau of the Neilgherry hills should prove to be adapted for their growth, their cultivation might be indefinitely extended in a climate suitable for English settlers.

Previous to my arrival on the hills Mr. McIvor had selected a site for the highest plantation in a wooded ravine or *shola* at the back of the hills which rise above the Government gardens; and, after a careful examination, I came to the conclusion that it was well suited for the growth of the hardier species, and for the experimental culture of all the kinds which have been introduced into India. It has been named the "Dodabetta" site, from the peak, the highest point of the Neilgherries, and 8640 feet above the sea, which rises up immediately behind it.

With regard to the species for which I considered the Dodabetta site to be suitable, it will be well in this place to recapitulate the circumstances under which they grow on their native mountains.

The shrub variety of *C. Calisaya* (lat. 13° to 15° S.) flourishes in open *pajonales*, quite exposed, at elevations from 5000 to 7000 feet above the sea, and in April and May I found the mean temperature to be 60⅓°, minimum 55°, and range 17°. The *C. nitida* (lat.

10° S.) grows at similar elevations, but we have no exact information respecting the temperature and humidity. The varieties of *C. Condaminea* (lat. 4° S.) flourish at heights from 6000 to 8000 feet above the sea, where the mean range is from 45° to 60°, in a moist climate, and in exposed but always dry situations; and one kind, the *C. crispa*, the seeds of which have been received in India and Ceylon, grows in a deposit of peat, 8000 feet above the sea, in a temperature falling as low as 27°.[417] The *C. lancifolia* (lat. 5° N.) is found at 7000 feet above the sea and upwards, where the annual range is from freezing-point to 75°, in an exceedingly moist climate. The rainy season lasts for nine months, when the constant rain is only interrupted in the day by interchanging sun-rays and fog-clouds. In the dry season cold clear nights follow days in which a warm sun penetrates through the fog, which almost constantly lies on the damp foliage of the forest.[418] Mr. Cross mentions that he saw trees of *C. succirubra* on his way to Loxa, growing at elevations of from 8000 to 9000 feet above the sea.

The site, in the Dodabetta ravine, slopes down from 7700 to 7600 feet above the sea, yet, from local causes, it is several degrees warmer than the station at Ootacamund; and the temperature agrees with that of the species of chinchona-plants described above. The annual temperature of the peak of Dodabetta, of Ootacamund, and of the warmer station of Kotergherry, are given on the following page.

The Dodabetta site, being four or five degrees warmer than Ootacamund, throughout the year, has a temperature, on the whole, somewhat warmer than the lofty regions where the species of chinchona grow, for the cultivation of which this position was selected. The elevation above the sea exactly corresponds, and the amount of humidity is about the same. The ravine is full of fine trees, with a variety of exposures, the general aspect being north-west; a clear little stream flows through it; and, in most parts, the soil consists of a rich loam four or five feet deep. Outside the wooded ravine there are tree Rhododendrons, Berberis, Gaultherias, lilies, Lycopodia, and brake-ferns, scattered about on the grassy slopes; and the character of the scenery and vegetation very closely resembles that of the *pajonal* country between the valleys of Sandia and Tambopata in Caravaya, where the shrub *Calisaya* flourishes. The site is protected by rising grounds from the cold northerly winds, and the colder breezes blowing over it from ridge to ridge prevent the warm air in the ravine from rising, so that the temperature became warmer as we ascended through the wood, and in the highest part there were orchids and pepper-vines hanging on the trees.

Observations by T. G. TAYLOR, and by Capt. OUCHTERLONY.

PEAK OF DODABETTA, Lat. 11° 23′ N., 8610 ft. above the Sea.				Dodabetta Site.	OOTACAMUND, 7300 feet above the Sea.						KOTERGHERRY, 6100 feet above the Sea.					
Month.	Max.	Min.	Mean.	Mean.	Wind.	Mean. Sunrise.	Mean. 2·40 P.M.	Mean. Sunset.	Mean Range.	Rain-fall.	Wind.	Mean. Sunrise.	Mean. 2·40 P.M.	Mean. Sunset.	Mean Range.	Rain-fall.
	°	°	°			°	°	°	°			°	°	°		
Jan. ..	58·6	44·4	51·5		Cold, N.E.	42	63	58	21	1	N.E. & N.W.	51·5	66	60	15	2
Feb. ..	56·7	45·9	51·3		Do.	44	65	60	21	1	N.E. & N.W.	52·5	67	63	15	3
March ..	61·7	47·1	54·4		Cold & dry, N.E.	49	68	63	19	2	N.E. to S.E.	54	67	63	13	6
April ..	61·3	51·2	56·2		Do.	54	68	63	14	5	N.E. to S.E.	56	68	64	12	10
May ..	62·4	49·9	56·1		Varies to S.W.	54	68	63	14	6	N.W.	56·5	68	64	12	2
June ..	54·9	46·1	50·5		Strong S.W.	53	64	59	10	8	N.W. to S.W.	58	69	65	11	2
July ..	54·4	47·9	51·1		S.W. and W.	52	62	57	10	7	Light S.W.	60	70	65	10	4
Aug. ..	55·1	46·8	50·9		W. and N.W.	52	62	57	10	6	N.W.	60	71	65	11	2
Sept. ..	54·9	47·4	51·1		N.W. ..	52	62	56	10	7	N.W. to West.	59	69	64	10	2
Oct. ..	55·6	48·1	51·8		N.E. and E.	51	62	56	10	9	N.W. ..	56	68	63·5	12	10
Nov. ..	55·6	47·2	51·4		N.E. ..	49	61	55	12	5	N.E. ..	54	67	61	13	2
Dec. ..	54	45·1	49·5	° 59	N.E. ..	45	60	55	15	3	North.	52	66	60	14	5
										60						50

The analogy between the flora of the Dodabetta ravine and of the loftier parts of the chinchona region was another point which influenced my decision. Within the ravine there are nine species of chinchonaceous plants, namely—

Hedyotis Lawsoniæ.	*Canthium umbellatum.*
Hedyotis stylosa.	*Grumilea elongata.*
Lasianthus venulosus.	*Grumilea congesta.*
Coffea alpestris.	*Psychotria bisulcata.*
Coffea grumelioides.	

These are mostly ornamental pretty shrubs, from six to eight feet high, with clusters of white or cream-coloured flowers. The other genera of which the wood is composed are as follows:—*Vaccinium*, *Myrsine*, *Symplocos*, *Ilex*, *Michelia*, *Sapota*, *Isonandra*, and *Cinnamon* among the trees; *Eugenia*, *Myrtus*, *Jasminum*, *Osbeckia*, *Sonerila*, *Solanum*, *Viburnum*, and *Acanthus* among shrubs; *Lonicera*, *Passiflora*, *Rubia*, and *pepper-vines* among the climbers; with an undergrowth of *Lobelia*, *Begonia*, *Convolvulus*, orchids, and ferns. The *Osbeckias* and *Sonerilas* represent the melastomaceous plants, the constant companions of chinchonæ in South America.

It was no small advantage that this excellent site for a chinchona plantation was close to the Government gardens, and that it would thus be under the constant supervision of Mr. McIvor. It receives a supply of moisture during both monsoons, and is, therefore, as good a position as could have been selected on the higher plateau of the Neilgherries,

though there are many *sholas* which will be found equally well adapted for the growth of the hardier chinchonas. These precious plants will, it is to be hoped, before very long, form large plantations on all parts of the hills, and become one of the most important products of the Neilgherries. In the mean while Mr. McIvor, the Government Superintendent, using the Dodabetta site as an experimental plantation, will be enabled to demonstrate the successful results of chinchona culture, and to raise thousands of plants for the supply of private enterprise.

The most extensive operations must, however, necessarily be carried on at much lower elevations, where the *C. succirubra*, the species richest in febrifugal alkaloids, will flourish best, and where vast unoccupied forests afford space for plantations on a large scale. A northern aspect is the one best adapted for the vigorous growth of trees on the Neilgherry hills, and we, therefore, proceeded to examine the forest-covered slopes overlooking the table-lands of Wynaad and Mysore, for a site for the lower chinchona plantation. We started from Ootacamund early one November morning, and rode across the central plateau of the hills, consisting of rounded grassy undulations, intersected by wooded *sholas*. In some of the hollows the streams had formed large swamps, where there were extensive deposits of peat. The traveller's bungalow of Pycarrah, the first on the road towards Wynaad, is ten miles from Ootacamund, on the banks of a river of the same name. Several huge boulders of syenite obstruct the stream and cause it to foam noisily round them, and the wet stones were covered with *Podostemads*, herbaceous branched floating plants, with the habit of liverworts. We saw several otters playing in the water, and peering at us from behind the rocks. Six miles beyond Pycarrah is the bungalow of Neddiwuttum, on the edge of the rapid descent into Wynaad, and the road descends from the upland slopes through a jungle where the ferns first appear, and maiden-hair, ceterach, and other ferns grow by the roadside. Some garden marigolds from England had been planted near the Neddiwuttum bungalow, and they had spread themselves in masses over the adjacent slopes.

The tract of forest land which we came to examine is close to the bungalow, and from the grassy hill above it there is a glorious view of Wynaad, and of the plains of Mysore, stretching away to the horizon. Here the mountains sink abruptly down to the Wynaad table-land, and the Moyaar river thunders down in a long waterfall, divides Wynaad from Mysore, and, flowing through a deep gorge to join the Bowany in Coimbatore, eventually swells the waters of the great river Cauvery. The land available for immediate occupation comprises about 400 acres of uncleared forest on the mountain slopes, at an elevation from a little over 6000 to a little under 5000 feet above the level of the sea, and with a mean temperature about 8° warmer than that of Ootacamund.

I selected this site for a plantation of *C. succirubra*, *C. Calisaya*, *C. micrantha*, and the very delicate *C. Peruviana*, because, with a good supply of water, and a deep rich soil on a base of decomposing laterite and syenite, it had a suitable elevation above the sea,

temperature, and amount of humidity. The information we possess on these points, with regard to the above species, is by no means complete; but it is sufficiently exact to enable us to form a correct opinion. Mr. Spruce gives the following details respecting the climate of the region of *C. succirubra*, in latitude 1° 40′ S. The zone of the "red bark" is from 2450 to 5000 feet above the sea.

1860. — Month.	Mean Min. for 7 months, ° 61½	Mean Max. for 7 months, ° 72⅕	Mean of Minima & Maxima, ° 66¾	Lowest Temperature. ° 57	Highest Temperature. ° 80½	Range in 24 hours. — Entire range in 7 months, ° 23½
	°	°	°	°	°	°
June ..	61⅕	74	67½	60¼ on the 27th.	77 on the 29th.	12⅘
July ..	60	72½	66¼	57 on the 11th.	80½ on the 27th.	12½
Aug. ..	61⅓	74⅔	68	59¾ on the 12th.	80¼ on the 28th.	13⅓
Sept. ..	62¼	72½	67⅓	60 on the 16th.	80 on the 19th.	10¼
Oct. ..	62	70	66	60 on the 21st.	74 on the 24th.	8
Nov. ..	62⅕	71	66½	58 on the 29th.	75 on the 30th.	8⅘
Dec. ..	62	71½	66¾	..	..	9½

From the 1st of June to the 31st of December is the dry season in the "red-bark" region, when the days are usually sunny in the early morning, and mists generally begin to form as the sun declines; while after the autumnal equinox there are heavy rains and thunder-storms. In the wet season the early part of the day is foggy, and there is heavy continuous rain during the afternoons and nights. In the region of *C. Calisaya*, from 13° to 16° S. lat., and from 4000 to 6000 feet above the sea, the dry season lasts from April to the end of August. April and August are showery months. May is also showery, but clear in the forenoons, and the mean temperature during the first half is 69°, mean maximum 71½°, and mean minimum 62½°. June and July are hot dry months, with little rain, a bright hot sun in the day, but cold clear nights. In September the rains begin, increase in October, and pour down incessantly from the beginning of November to the middle of March, with very hot, damp days and nights. We have no detailed information respecting the region of *C. micrantha* and *C. Peruviana*, species which flourish in 10° S. lat., from 4000 to 5500 feet above the sea. From May to November the sun shines powerfully, yet heavy rains fell from day to day in June and July 1860, and it was not until August that the days were clear and bright. At Casapi, in this region, where a register was kept, it rained during half the days in the year.[419] From November to May is the rainy season, and sometimes the rain pours down for six or seven days without intermission.[420]

The Neddiwuttum site, being about 8° or 10° warmer than Ootacamund, has a temperature exactly similar to that of the forests where the above species of chinchonæ flourish. Its elevation above the sea is also the same as that of the chinchona forests. It is true that Mr. Spruce gives the extreme upper limit of the "red-bark" region at 5000 feet; but Mr. Cross saw that species growing at an elevation of 8000 feet; and the great importance of cultivating this species at the highest possible elevation is demonstrated by Mr. Spruce's observation that the bark of trees growing low down and near the plains is by no means so thick as that of trees which flourish in a loftier and more temperate climate.[421] The Neddiwuttum site is within the limit of the region which receives both monsoons. Though protected to some extent from the south-west, it receives a full share of the rains during the summer, and is also supplied with moisture by the north-east monsoon, coming across Mysore between October and December. During the remaining months it is visited by mists and heavy dews in the nights until the south-west monsoon again commences in May. It will probably be found that these species of chinchonæ will bear a much drier climate than we at present suppose; and I have no misgivings that the amount of humidity at Neddiwuttum will not be amply sufficient for their successful cultivation. The only person who has visited this site since its selection, who is capable, through personal knowledge of the South American chinchona forests, of forming an opinion, is Mr. Cross. It is exceedingly satisfactory to find that he not only approves of it for the cultivation of plants of the "red-bark" species, but that, from the superior depth and richness of the soil, he considers that they are likely to thrive even better than in their native forests near Limon, on the eastern slopes of Chimborazo.

In the Neddiwuttum forest, among other plants, I found the *Hymenodictyon excelsum*, [422] wild yams, coffee-plants, cinnamon, pepper-vines, *Andromedas*, *Osbeckias*, wild ginger, a *Balanophra* with a scarlet flower, and abundance of orchids and ferns. On the edge of the forest there was a little hut, merely a few branches covered with grass, and leaning against the trunk of a tree, with some empty honeycombs lying about. It was the habitation of a family of Mooloo Kurumbers, a wild race who live in the forests, and run away in great terror when any one approaches them. The establishment of the plantation will soon make them alter their haunts from the neighbourhood of Neddiwuttum.

The magnificent view from this point embraces a great part of Wynaad. Far below there was a small coffee-estate, its bright green contrasting with the more sombre hues of the surrounding forest; and more to the left, though out of sight, is the extensive plantation which, together with a tract of forest on the slopes of the Neilgherries, is owned by Messrs. Ouchterlony and Campbell.

After passing the night at Pycarrah, we started next morning to examine another site further to the eastward, and overlooking the plateau of Mysore. We crossed several ranges of grassy hills, with streams in the intervening valleys flowing through thickets of

tree rhododendrons, with the gorgeous crimson flowers just beginning to bloom, *Osbeckias*, and a *Lasianthus* with a beautiful glossy leaf. The hills were dotted with a St. John's-wort with a bright orange flower (*Hypericum Hookerianum*). We soon reached the edge of the plateau, overlooking the low country, and looked down on the wide plains of Mysore, with some Neilgherry peaks in advance of us, and a valley between, where there was bright green cultivation, and crimson patches of amaranth, surrounding the Badaga village of Choloor. Between the place where we stood and the Choloor valley there were some fine patches of forest on the steep hill-slopes; but they did not offer the same advantages as Neddiwuttum for a first experimental chinchona plantation. This side of the hills is drier, the soil poorer, and water is less abundant, though it is nearer Ootacamund, and both labour and supplies are more easily procurable. Returning to Ootacamund we rode up to a Todar-mund, where something unusual had evidently occurred. About thirty Todars were walking in a line through the forest glades below, and several jackals were prowling about in the broad daylight. We afterwards heard that a huge tiger had killed one of the Todar buffaloes that morning, and retreated into the *shola* on the edge of which we had just had luncheon. They expected him to come out at sunset for his supper.

We continued our excursion to the summit of the Kalhutty peak, overlooking the Seegoor ghaut, whence several fine tracts of forest-land slope down; but Neddiwuttum was decidedly preferable in every respect to all the localities which we examined on the northern side of the Neilgherries, and to the eastward of that site. The part of the hills on the south, towards Coonoor and Kotergherry, was out of the question on account of the summer drought, as it is completely screened from the south-west monsoon by the spurs from the Dodabetta peak; and the forests towards the Sispara ghaut, being too far west to receive moisture from the north-east monsoon, were not so good as Neddiwuttum, at least for a first experiment.

When the success of the chinchona culture on the 400 acres of the Neddiwuttum plantation is fully established, the experiment may then be extended to the east and west, both by Government and through private enterprise; and these precious barks may be expected to yield remunerative profits to European speculators, while they will at the same time confer an inestimable blessing on the native population.

Everything, however, depends upon the method which is adopted for the cultivation of the chinchona-plants in the experimental plantations; and, in a future chapter, I propose to give a detailed account of the course of events, as regards the chinchona-plants on the Neilgherry hills, up to the latest date.

CHAPTER XXIV.

JOURNEY TO THE PULNEY HILLS.

Coonoor ghaut—Coimbatore—Pulladom—Cotton cultivation—Dharapurum—A marriage procession—Dindigul—Ryotwarry tenure—Pulney hills—Kodakarnal—Extent of the Pulneys—Formation—Soil—Climate—Inhabitants—Flora—Suitability for chinchona cultivation—Forest conservancy—Anamallay hills.

In the end of November I set out from Ootacamund, by way of the Coonoor ghaut and Coimbatore, with the intention of examining the suitability of the Pulney hills in Madura for chinchona cultivation. The Coonoor ghaut, on the southern side of the Neilgherry hills, leads down into the plain of Coimbatore. The road is good, though much too steep ever to make a convenient means of carriage traffic, and the scenery is exceedingly fine. The deep gorge has forest-covered mountains on the left, and a grand range of cliffs on the right, crowned by the bold peak of the Hoolicul Droog. There are few districts in India without some local tradition respecting the five Pandus,[423] the great mythical heroes of ancient Hindoo history, and the Hoolicul Droog is not without one. It is said that the fort on the summit of the Droog was inhabited by a *rakshi* or giant named Pukasooren, who levied a tribute on the people of the plains, in the shape of a cart-load of provisions daily. When he had eaten the provisions he swallowed the driver, and kicked the cart down again. Bhima, the impersonation of strength, when passing through this part of the country, volunteered to act as driver, had a desperate encounter with the giant, and killed him. The dying Pukasooren cursed the whole country over which the shadow of the mountain fell during the day, and it has ever since been the abode of a deadly fever. It is certain that the jungles at the roots of the hills are the most fever-haunted districts in India, and I rode rapidly through this belt of forests, and along a road bordered with *cana-fistula* and *sappan*-trees,[424] to the village of Matepoliem, on the banks of the river Bowany, and five miles from the foot of the ghaut.

Matepoliem is twenty-three miles from the town of Coimbatore, and I rode this distance on a Neilgherry pony in the early morning. The road is perfectly straight, with an avenue of shady trees along the whole length, and good bridges over the dry sandy water-courses. The soil appeared to be poor, partly waste, and partly cultivated with *cholum* (*Sorghum Vulgare*[425]), *lablab*,[426] and sesame. *Cholum*, or great millet, is much cultivated in the peninsula, and used as food in the shape of cakes and porridge, where rice is scarce or too expensive. It grows to a height of five or six feet, and cattle are very fond of the straw, which contains sugar, but it soon exhausts the soil, and two crops are never taken off the same land in succession. There are two villages on the road between Matepoliem and Coimbatore, called Karamuddy and Goodaloor, in both of

which there is a *choultry* or native bungalow, and in the latter an English post-house. At Karamuddy there is a very picturesque temple, and on the roadside I passed several horses of earthenware, votive offerings by the potters to their god. Under many of the trees there are images of the elephant-headed, pot-bellied god of wisdom, Ganesa, anointed with ghee, and adorned with garlands of flowers.

The streets of Coimbatore consist of long rows of red-tiled, mud-walled buildings, with no windows, and overhanging eaves supported by wooden pillars, under which there are raised platforms where the people sit and talk. In peeping in at the doors, I could never discern any article of furniture in the dark obscurity of the interiors, but they generally looked clean and well swept. The houses of the English officials are about a mile from the town, generally surrounded by park-like compounds, but the trees and grass thrive badly in the shallow sandy soil. Outside the town there are two very large tanks, one nearly a mile long, which irrigate some rice-fields. The view is very pretty, with these extensive sheets of water in the foreground, the cupolas of temples rising above the trees beyond, and Lambton's Peak with the blue line of the Neilgherries in the distance.

Some exertions are being made at Coimbatore, both by Protestant and Roman Catholic missionaries, and about sixty natives attend the little chapel of the London Mission Society. The Bible is very properly not admitted into any of the Government schools, and, strange to say, educated natives often inquire why this is not done, and why Christians are ashamed of their Shaster. But in schools unconnected with the Government the study of the Bible is enforced like any other class-book, and there are upwards of forty Brahmin youths in Coimbatore who habitually take it home to learn, with their other lessons, and never make the slightest objection. Mr. Thomas, the Collector, felt very strongly the great importance of educating the women, and a girl-school has been set on foot, after much difficulty. At present the influence of the women, and all women have influence, is for evil. The men, to maintain their superiority, dislike the women to know anything, and the head official of the cutcherry at Coimbatore, who is a Brahmin, dare not let his friends know that his wife can read and write, though this accomplishment makes her a more useful and agreeable companion. The women, generally, are treated like slaves by their husbands. They are never allowed to eat at the same time, except on the wedding-day, and must walk behind their husbands on a journey, generally carrying a child on their hips; yet I have seen the man carrying the child, and at least taking turn about, and in other respects they always appeared to be on good terms with each other.

At Coimbatore I bought a *bandy* or country cart of the simplest construction, with two wheels, no springs, and a hood of matting spread over curved canes; and started, with relays of bullocks posted at intervals of fifteen miles. This mode of travelling is inconceivably slow, the rate being about three miles an hour, and it was near sunset

before I reached Pulladom, a village twenty-two miles from Coimbatore. The road is nearly straight, and planted on both sides with trees of stunted growth, owing to the shallowness of the soil. It was market-day at Pulladom, and people were sitting in rows, before piles of cotton cloths, rice, and dry grains; while an old Tahsildar, in spectacles and snow-white garments, was holding a court under a verandah. In strolling about I came upon the huge idol-car belonging to the village, on heavy wooden trucks. The carvings on its sides were very elaborate, with elephant-headed gods at the angles; but it is only dragged out on very great occasions, and will require new trucks before it is moved again.

All this country round Coimbatore produces much cotton, and cloths are manufactured in great quantities, which supply garments, such as they are, for the people of the plains, as well as for the hill tribes of the Neilgherries. The native cotton is of two kinds, called *oopum-parati* and *nadum parati*.[427] The seed of the latter is sown broadcast, in the same field with *cholum* and *cumboo*.[428] After the grain is cut, the ground is ploughed between the plants four times, and in the next year the cotton yields a small crop in July, and a larger one in the following January. After the third year the field is manured and cultivated with grain for two years, cotton being again sown when the third crop of grain has been reaped. This *nadum* cotton is very little cultivated in the Coimbatore district. The chief product is the *oopum*, the best indigenous cotton, raised, in rotations of two years, with *cumboo* and *cholum*.

The *oopum* cotton is raised on the black soil,[429] an adhesive black clay, while the little Bourbon cotton that is cultivated is grown on red soil. It is picked very carelessly, and the bales are so badly pressed that those which I passed in carts on the road looked as if they would sink in like a feather-bed, if any one sat upon them.

Much pains have been taken by the Government for a series of years to improve the method of cultivating cotton in India, and to introduce American and other species; and very large sums of money have been spent on experiments. Bourbon cotton was cultivated in Coimbatore as early as 1824; and in 1842 Government cotton-farms were established for the growth of New Orleans and Indian plants, both in the black and red soils, under the able superintendence of Dr. Wight, the eminent botanist. In 1849 these experiments were abandoned.

The great importance of the question of cotton supply from India has been long felt, and never more so than at the present time. To meet the requirements of the English markets numerous and costly attempts have been made during a course of years to introduce the American species, which produces a much longer staple than the indigenous Indian kind. Yet American cotton has not hitherto been raised so as to yield a profitable return, excepting in the province of Dharwar, in the Bombay Presidency. The success in this instance is chiefly to be attributed to a suitable soil and climate; but also, in no small degree, to the energy of Mr. Shaw, a former Collector.

Great attention has been paid to the nature of the soils, while less importance than it really deserves has been attached to climate, though climate, and mainly one element of climate—the moisture of the atmosphere—is an essential condition in the successful culture of American cotton. In travelling southward from the latitude of Bombay the climate becomes gradually moister, and at 300 miles there is a very decided change. The American cotton-plant has a very different constitution from the Indian; it cannot stand so much drought, and the conditions required for its culture are an equable and moderate supply of moisture through all the stages of its growth. These conditions are fulfilled in the Dharwar country, which retains a considerable quantity of moisture in the air during the cold season, when other parts of the Bombay Presidency are intensely dry. Wherever this is the case, as in Sind, Guzerat, Broach, and Ahmednuggur, the American plant will not yield a remunerative crop. The indigenous plant is able to endure this dry season well, because it is a native, not of the peninsula, but of the arid country of Sind and part of the Punjab, where it grows wild.

If careful hygrometrical observations were taken throughout the year in the various cotton districts, the results might be compared with similar observations taken in Dharwar; and thus the localities may be ascertained where the American cotton can be advantageously cultivated, so far at least as this depends on the amount of moisture in the atmosphere. The supply of aqueous vapour in the atmosphere, at any period of the year, diminishes as we recede from the coast; but, having once found a centre where the American plant can be profitably raised, in Dharwar, it is advisable to work from that centre, especially in a south-eastern and southerly direction. This spread of the growth of American cotton has already taken place to the eastward of Dharwar, to a considerable extent. The people in the Bellary district, and in neighbouring parts of the Nizam's territory, have for some years grown cotton from American seeds, and value it more highly than their native species.

In Coimbatore, where scorching hot dry winds parch up the plains during part of the year, and where the rainfall varies so much in different seasons,[430] sometimes being thirty inches, and at others only seven inches, it is perhaps doubtful whether it will ever answer to cultivate American cotton on a large scale, yet excellent samples were obtained from cotton raised on the farms, under the superintendence of Dr. Wight. The attention of Sir William Denison, the present Governor of Madras, has been chiefly directed to the improvement of native cotton, by increasing the length of the staple, and lessening the coarseness of the fibre. It is a well-established fact that "the best seeds make the best breeds,"[431] and Sir William Denison proposes to select those seeds to which the largest fibres are attached, to be used for the next crop, and so on in each successive season, the minimum length being increased every year. He believes that, in this way, a permanent addition may be made to the length, and possibly to the fineness of the fibre of the native cotton, which might thus ultimately be able to compete in the English markets with its American rival. Mr. Haywood, the Secretary of the Manchester

Cotton Company, on the other hand, strongly urges that attention should be given to the improvement of American cotton. Well-directed efforts in both directions will doubtless be rewarded.

I left Pulladom in the night, and arrived at the large village of Dharapurum in the following morning, a distance of twenty-eight miles. Dharapurum is on the banks of a small river, where there are rice-fields and cocoanut-trees; for wherever there is the means of irrigation, rice is always cultivated. Great quantities of cows and calves swarm along the roads, and in the open spaces of the village, where there are some fine spreading peepul-trees (*Ficus religiosa*), one of the sacred trees of the Hindus. It has a peculiarly shaped cordate leaf, with a long narrow acumen one-third the length of the leaf, and yellow flowers; and it is venerated from a belief that the god Vishnu was born amongst its branches. Potters' horses, and images of the elephant-headed Ganesa, were placed under the trees, the objects of worship by the villagers, who make offerings of ghee and flowers to them. Literally "an idol under every green tree."

After leaving Dharapurum the road becomes very sandy, and passes over a bleak open country covered with low bushes, on the frontier between the Coimbatore and Madura collectorates. A range of mountains bounded the view to the south. A slow jolting journey of thirty miles brought me to the village of Pulkanooth in Madura. *Cholum* and *lablab* were cultivated in the surrounding fields, and from the top of a ridge of rocks overhanging the village there is an extensive view of open country covered with waving *cholum*, and bounded by the broken outline of the Pulney hills. Near the village there is the ruin of a square brick fort, with bastions at the angles, entirely overgrown with bushes. One of the happiest signs of English rule is to be found in the number of ruined forts scattered over the country, once the lurking-places of brutal robbers who extorted half the crops from a wretched peasantry, whose descendants now reap the fruits of their labour in peace.

In taking a walk near Pulkanooth I encountered a marriage procession. First came a man with a drum, then two more with a gong of skin stretched on wooden hoops, then a man with a large game-cock under his arm, then a bullock led by a woman, then four women covered with bracelets and anklets, then a pony ridden by a boy about twelve, with nothing on but a red turban and gold necklace and bracelets, with a little girl about five in front, whom he clasped round the waist; then more men and women, another drum, and lastly a small boy mounted on a large cow. They appeared to have come from a distance, as they stopped to rest under a peepul-tree, by the road-side.

Another night journey took me to the town of Dindigul, a pretty little place at the foot of an isolated mass of primitive rock, whose perpendicular sides are crowned by a dismantled fort, said to have been erected in the days of Dupleix and French ambition, and to have been occupied and long held by Hyder Ali of Mysore. Here the plains are chiefly covered with *cholum* and *cumboo*; and between the town and the rock there is a

grassy esplanade, a grove of cocoanut and betel-palms, and a neat little temple to Ganesa. Troops of young girls were drawing water from a tank near the esplanade. Their slight graceful figures, supporting chatties on their heads, were perfect models of beauty; but they had black ugly faces, flabby ear-lobes, and large studs stuck in their noses. To be admired their backs must be turned.

The Tamil people, who inhabit this part of India, are an exceedingly black and ugly race, and the Brahmins are the only people who have any pretensions whatever to fair skins. On the whole the peasantry in the country between the Neilgherry and Pulney hills appeared to be tolerably well off, and the country was well cultivated, considering the unpropitious climate and poor soil. As is well known, the people in this part of India hold their land by what is called the *ryotwarry* tenure, which is a settlement for the land assessment with each individual ryot or cultivator, without the intervention of any zemindar or renter. The land is made over to the actual cultivator, who is regarded by the Government as the proprietor of the soil, and the arrangement for the payment of land-tax is made directly with him, while he receives assistance by remissions of assessment in unfavourable seasons, and cannot be ejected so long as he pays his dues.

The land is classified as irrigated and un-irrigated, and then according to its different degrees of fertility; and this settlement is permanent so long as the land remains in the same condition. The Collector of each district makes an annual tour of inspection, called *jummabundy*, to ascertain the extent to which the Government demand ought to be reduced, owing to particular circumstances of season; but in ordinary times the duty of collection is intrusted to the Tahsildars or native officials, and their subordinates the Sheristadars. These officials, who visited me in the villages through which I passed, appeared intelligent respectable men, and all the younger ones talked English fluently.

Sir Thomas Munro, who was Governor of Madras from 1818 to 1827, established the *ryotwarry* system, and since his time the conditions on which the ryots hold their land have been made lighter and more advantageous. In 1837 it was enacted that there should be no increase of land-tax on account of the growth of more valuable crops; in 1852 it was ordered that no ryot should pay an additional tax on account of improvements made by himself, causing an increased value;[432] and, during Lord Harris's administration, considerable reductions were made in the land-assessment in nearly all the Madras collectorates. These reductions, independent of the boon conferred on the people, have been attended by the most successful results, in an increasing revenue, and in the extension of the area of cultivation over lands which were formerly waste.

Dindigul is about forty miles from the foot of the ghaut leading up to the Pulney hills, and relays of bullocks were posted for me every seven miles, with a man running in front of the cart with a blazing torch. Passing through the village of Periacolum, round which there are many large tanks and extensive rice cultivation, we reached the jungle at the foot of the Pulney hills at early dawn. The path, which is only practicable for

ponies and pack-bullocks, leads up a ravine for half the distance, and then corkscrews up the steep sides of the mountain. The range looks very imposing from the plain, but not equal to the Neilgherries at the foot of the Coonoor ghaut. After resting under a clump of trees I commenced the ascent on foot, driving an unhappy sheep before me, which was to be sacrificed on the summit, where, at this time of the year, there are no residents, no market, and no means of procuring any supplies.

The ascent is exceedingly beautiful, but the undergrowth is thick grass, and the vegetation is not nearly so luxuriant as at similar elevations on the Neilgherries. The trees are chiefly *Leguminosæ*, and at an elevation of 3000 feet chinchonaceous plants commence, amongst which I observed the *Hymenodictyon excelsum*. At 6000 feet the steep ascent is covered with long grass, and trees are confined to sheltered hollows and ravines. After reaching the plateau it is necessary to scale a second steep grassy slope before arriving at the settlement of Kodakarnal, which is 7230 feet above the level of the sea. Kodakarnal consists of eight houses, built along the crests of undulating hills, and one of the inner slopes is clothed with a wood of fine trees and tree-ferns, from which the Tamil people have named the settlement.[433] Round the houses there are gum-trees. *Acacia heterophylla*, *Cassia glauca*, fruit-trees, and hedges of roses and geraniums as at Ootacamund. The houses belong to the officials of the Madura district, the American missionaries, a Mr. Clerk of Madras, and the French priest of Pondicherry, who come here to recruit their healths, and for short intervals of holiday and relaxation.

Mr. Ames, the Sub-Collector at Dindigul, had kindly given me the use of a house which he shared with Mr. Levinge, the Collector of Madura. It has a pleasant garden, whence there is a glorious view of the Madura plains, with their numerous tanks glittering in the sun; and close to the house a torrent of deliciously cold water babbles over huge boulders of rock, and finally leaps in long falls down the face of the cliffs, making a noise at night like the roar of the sea. The house was in charge of a very original old native of low caste, with a large family, named Chenatumby, who is a tolerable gardener, and cultivates his own patch of potatoes. Chenatumby is a devoted Protestant, feels a conscientious horror for the idolatry of the Roman Catholics, and intends to bring up his eldest son as a half-caste, this honour being conferred on him by the simple process of attiring him in a hat and trousers. Old Chenatumby acted as a guide in my walks over the hills, and was very useful.

The Pulney[434] or Varragherry hills, like the Neilgherries further north, branch out in an easterly direction from the main line of the western ghauts. United to a portion of the Anamallay range at their western end, they stretch out into the Madura plains for a distance of fifty-four miles, with a medium breadth of fifteen, and an area of 798 square miles. On the south they rise very abruptly from the plains, presenting, near their summits, a perfect wall of gneiss; but on the north and east they slope down in a

succession of broken ridges. The Pulneys are divided into two parts: a lower series of hill and dale to the eastward, called Mailmullay or Kunnundaven, averaging a height of 4000 feet, and covering 231½ square miles, where there are extensive tracts of forest, some cultivation, and several villages; and a loftier region to the westward 6000 to 7500 feet above the sea, with undulating grassy hills and mountain-peaks, the highest of which, Permanallie, attains an elevation of 8000 feet.

The formation is gneiss, interstratified with quartz, and traversed by veins of felspar; and the rock is generally decayed to a considerable depth on the plateau, and disintegrated so as to form a gritty clay. In the eastern part the soil is a light reddish loam; but on the western and loftier half it is very poor, being a heavy black peat several feet thick, with a stiff and plastic yellowish clay as a sub-soil. The rains on the Neilgherry hills have the effect of mixing the decaying grass with the decomposed rock, and a rich soil is thus formed; but on the plateau of the Pulneys this operation does not appear to take place, the one becoming a black peat, and the other a stiff clayey subsoil. These remarks, however, only apply to the interior valleys, for on the outer slopes, overlooking the plains of Madura, there is plenty of good soil, and magnificent forests clothe the mountains at the foot of the perpendicular walls of gneiss which form the southern ridge of the Pulneys.

The climate of the Pulneys, as regards temperature, very closely resembles that of the Neilgherries. At the time of my visit, in the end of November and beginning of December, the season was very late, though there were thick mists and showers of rain every afternoon. This is the time of the north-east monsoon, and the streams swell to torrents after every shower. During the first two months in the year it is very cold, and the ground is often covered with frost on the upper plateau. In March there are light showers of rain, which increase during April and May, and continue, with strong westerly winds, until October. Thus the Pulneys are within the influence of the south-west monsoon.[435] In June and July, the warmest months, the thermometer never falls below 50°, nor rises above 75°; and the westerly winds, with occasional rain, continue during August and September.

The eastern part of the Pulneys, called Kunnundaven, and Poombary, the principal village to the westward, are inhabited by people of the Kunnuver and Karakat Vellaler castes, numbering about two thousand of both sexes. The villages are chiefly on the lower Pulneys, and one which I visited, called Vilputty, was surrounded by terrace cultivation of mustard, garlic, *raggee*, and *keeree* or amaranth. The people also cultivate *lablab*, limes, oranges, and plantains; and I heard that in one or two villages there were small coffee-gardens. Many low-country natives are also settled on the Pulneys, chiefly men outlawed from their castes; and in the more inaccessible forests are the Poliars, a race of timid wild men of the woods. Chenatumby told me that they have no habitations of any kind, but run through the jungle from place to place, sleep

under rocks, and live on wild honey and roots. The women run with them, like wild goats, their children slung in rows on their hips. The Poliars occasionally trade with the country people, who place cotton and grain on some stone, and the wild creatures, as soon as the strangers are out of sight, take them and put honey in their place, but they will allow no one to come near them.

The undulating hills and valleys of the interior plateau are covered with an aromatic grass (*Andropogon*), which grows in large coarse tufts, like the *Stipa ychu* in Peru; and it is not until the young tender shoots come out that it affords good pasture for cattle, of which there is a small herd on the hills, belonging to American missionaries and others. The grassy slopes are dotted with tree-Rhododendrons, Gaultherias, Osbeckias, Lobelias, the *Hypericum Hookerianum*, and brake ferns. This upper plateau is admirably adapted for the growth of English fruits and vegetables. In Mr. Levinge's garden there were bushes of Fuchsias, Daturas, roses, and geraniums; and behind the house grew peach, apple, plum, and loquot-trees, strawberries, potatoes, green peas, and artichokes.

Where there are springs or watercourses on the higher range, there are generally fine wooded "*sholas*" facing inwards, and very extensive tracts of forest on the outer slopes; but the timber, especially teak and black-wood, has been very extensively cut by the people of the hills. I examined a *shola* called Minmurdi-karnal near Pattoor, on the south side, another between that and Kodakarnal, and two others, and observed trees of the following genera:— *Michelia*, *Cinnamomum*, *Dodonæa*, *Millingtonia*, *Myrsine*, *Monocera*, *Symplocos*, *Bignonia*, *Crotalaria*, *Passiflora*, *Osbeckia*, *Jasminum*, *Hedyotis*, *Lasianthus*, *Canthium*, and *Hymenodictyon*. Tree-ferns abound near the streams, and in some of the jungles there were trees of enormous size. Early one morning I went with Chenatumby to see the "pillar-rocks," three miles to the westward of Kodakarnal. They consist of grand perpendicular cliffs descending from the grassy heights, with their bases clothed with forest. Two of them are separated by fissures from the main cliff, and have the appearance of gigantic columns. It was altogether a most magnificent sight, with volumes of fleecy clouds rolling up from the low country, and occasional peeps of the far-away plains and glittering tanks through their folds.

The natives have long been in the habit of recklessly felling the most valuable timber, and acres of fine *shola* used to be annually destroyed to make clearings for plantain and cardamom groves. For the latter, however, only the small trees and underwood are burnt on the Pulneys, the larger trees being left standing. But this wasteful destruction of timber has recently been checked by the authorities, and in 1860 Mr. Spershneider was appointed as overseer of the Pulney forests, with a small staff, to prevent the reckless cutting of timber, and to mark, from year to year, the trees which arrive at sufficient maturity, and are fit to be felled.

I came to the conclusion that in several of the wooded *sholas* the chinchona-plant might be cultivated with advantage, the *C. Condaminea*, and other species which thrive at great elevations, on the upper plateau, and the *C. succirubra* in Kunnundaven. Mr. Levinge, the Collector of Madura, takes an interest in the experiment, and Mr. Spershneider would be willing to superintend the chinchona plantations; so that, when the undertaking is in a sufficiently advanced stage on the Neilgherry hills to enable Mr. McIvor to distribute plants for cultivation in other parts of India, a number might advantageously be sent to the Pulneys. I understand, too, that it is in contemplation to form a Company for the cultivation of coffee on these hills, in which case it is to be hoped that the extension of the growth of chinchona-plants will be advanced by private enterprise, from motives of humanity as well as with a view to successful commercial speculation.[436]

I did not visit the Anamallay hills, to the south of Coimbatore and westward of the Pulneys, as no planter was as yet established on them, and a considerable time must elapse before they are prepared for the introduction of the chinchona-plant. At the time of my visit no bold clearer of jungles had ventured to invade the domains of the conservators of forests on the Anamallays.

Dr. Cleghorn reports that these hills are under the influence of the south-west monsoon, though not so much so as the Koondahs at Sispara: but I do not find that he gives any detailed account of the amount of moisture in the atmosphere during the winter. The soil is described as deep and covered with rich pasture, streams of water are numerous, there are table-lands 6000 to 7000 feet above the sea, and very fine timber in the ravines. The three hill-tribes, called Kaders, Poliars, and Malsars, trade in cardamoms, turmeric, ginger, honey, wax, resins, soapnuts, and millet. Dr. Cleghorn considers that, from the extent of forest, the resemblance of the flora to that of Ceylon, and the altitude, the Anamallays are suitable for the cultivation of coffee on a large scale, and for colonization of small communities of Englishmen.[437] In this case they are also adapted for the growth of chinchona-plants, and their introduction, which will of course be simultaneous with the settlement of Europeans, will be the more beneficial because the lower slopes of the Anamallays are the haunts of fevers. The quinine-yielding trees will confer blessings on those whose duties or interests oblige them to frequent the forests of the Anamallays, while their cultivation will be a remunerative speculation to the settlers on the upper plateau.

CHAPTER XXV.

MADURA AND TRICHINOPOLY.

Arrive at Madura—Peopling of India—The Dravidian race—Brahmin colonists in Southern India—Foundation of Madura—Pandyan dynasty—Tamil literature—Aghastya—Naik dynasty—The Madura Pagoda—The Sangattar—The Choultry—Tirumalla Naik's palace—Caste prejudices—Trichinopoly—Coleroon anicut—Rice cultivation—The palmyra palm—Caroor—Return to the Neilgherries—Shervaroy hills—Courtallum.

THE road from the foot of the Pulney hills to Madura, a distance of upwards of forty miles, is very bad, but it passes through avenues of shady banyan and peepul trees most of the way, and is, therefore, not so wearisome for the natives on foot, as for a European jolting at the rate of three miles an hour in a bullock-cart without springs.

Near Madura there are tracts of rice cultivation, plantain groves, and topes of palm-trees; and at sunrise I came in sight of the *gopurams* or towers of the great pagoda, rising above thick groves of palmyra palms, with a foreground of bright green paddy-fields. The city is very interesting from its remarkable palaces and temples, as the capital of a once powerful kingdom, and as the ancient centre of Tamil civilization: and a few words respecting the former history of this part of India appear necessary before describing the pagoda, and other architectural remains of the former greatness of Madura.

Tradition relates that in the most ancient times the country from the mouths of the Godavery to Cape Comorin was one vast forest. Here the great Aryan hero Rama is said to have resided during his exile, with his wife Sita, and here he commenced his wars against the Rakshasas or fiends, who divided with hermits and sages the possession of the wilderness. The simple truth probably is that these "fiends" were the original inhabitants of Southern India, which was called Dravida Desa, and that Rama was the first Hindu invader. Dravida denotes the country of the Dravidas, who are described in Sanscrit writings as men of an outcast tribe, descended from degraded Kshatriyas.

The history of the early peopling of India, by its various races, is involved in much obscurity; and the little light which has been thrown upon it is chiefly derived from a comparison of languages. The prevailing opinion is that India was originally inhabited by a people whose remains are to be found in the Koles, Sontals, Bheels, and other wild hill tribes; that the Dravidians, a Scythic people, came from the north, settled in Hindustan, and drove the aborigines into the hills and fastnesses; that in their turn the Dravidians were driven across the Vindhya mountains by another Scythic race, and became the ancestors of the present population of Southern India; and that finally the

Aryan race, with its Vedic civilization, brought this pre-Aryan Scythic race under subjection, and formed it into the servile Sudra caste.

Thus the Dravidian people of Southern India were of Scythic origin, and they spoke a language from which the four modern ones of the Madras Presidency, Tamil, Telugu, Canarese, and Malayalam,[438] are derived. These are all grouped as Dravidian languages, and their source is no longer a matter of doubt. It was formerly supposed that they were Aryan, from the great number of apparently Indo-Germanic roots; but it is now known, from the structure of their grammar, that they belong to the great Turanian or Scythic group of tongues. Mr. Caldwell considers that the Scythian family to which they are most closely allied is the Finnish or Ugrian;[439] and in this view Professor Max Müller concurs with him.[440] The ancient Dravidian religion, before the people were converted to the belief taught in the Puranas, also favours Mr. Caldwell's view. If we may judge from the creed which still lingers in Tinnevelly and other districts, it consisted in the worship of evil spirits by means of bloody sacrifices and frantic dances, while a Supreme Being was acknowledged but not venerated, and there was no trace of worship of the elements. In these respects it closely resembled the Shamanism of the Scythic races of High Asia.

It is tolerably certain that the Dravidian races had attained to some degree of civilization before the Aryans appeared in their country, and, with a system of castes, introduced the worship of Vishnu and Siva. One evidence of the ancient civilization of the Dravidians is that they possessed a system of numerals up to 1000, essentially the same in all the four languages; though in counting above 1000 they make use of Sanscrit numerals. From the existence of these native numerals among the Dravidian nations, Mr. Crawford draws the inference that these people must have attained a considerable measure of civilization before they adopted the Hinduism of the north, and hence stood in no need of foreign numerals.[441]

From the time of Rama, who appears to have been assisted in his invasion of Lanka (Ceylon) by a Dravidian chief, now deified as the monkey God Hanuman, the influence of Hinduism rapidly increased, and caste prejudices spread over Southern India. But the annals are far too obscure, and too deeply buried under extravagant fable, to enable us to form any idea of the time and manner of the complete inoculation of the Dravidian races with Brahminical legends, caste observances, and Hindu religious ideas. It is clear, however, that "to the early Brahminical colonists the Dravidians are indebted for the higher arts of life, and the first elements of literary culture."[442]

The Brahmins came to Southern India not as conquerors, but as peaceful settlers and instructors; and their influence was obtained through their superior civilization and learning. They gave the name of Sudra to all the upper and middle classes of native Dravidians, while the servile classes were not, as in Hindustan, called Sudras, but

Pariars. Thus, while in the north a Sudra is a low-caste man, in the south he ranks next to a Brahmin.

It is said that, after the avatur of Rama, pilgrims came in great numbers to visit the scenes of his triumphs, and, settling in the country, cleared land for cultivation, and laid the foundations of future principalities. One of these settlers was a man named Pandya, of the Vellaler or agricultural caste, who established himself in the south; and his descendant Kula Sekhara, son of Sampanna Pandya, was the first king of Madura. Some centuries elapsed, probably five, before the foundation of the city of Madura, during which the settlers were occupied in clearing the ground, and forming themselves into an organized state; and it has been conjectured that the building of the capital was commenced between 500 and 600 B.C. Previously the kings of the Pandyan dynasty resided at a place called Kurkhi.[443]

Another tradition states that a merchant lost his way in the forests, and discovered an ancient temple dedicated to Siva and his wife Durga, which had been erected by the God Indra. The merchant was directed by the God to announce to the Pandyan king, named Kula Sekhara, that it was the will of Siva that a city should be erected on the spot. Kula Sekhara, therefore, cleared the forest, rebuilt the temple, and founded a city. On the completion of the work a shower of nectareal dew fell from heaven, spreading a sweet film on the ground, and hence the name of *Madura* (sweet).[444]

The wife of Siva became incarnate as the daughter and successor of this prince, under the name of Minakshi; and Siva himself as Sundara, or the handsome, was her mortal husband. Thus the Pandyan kings, like many of the dynasties of ancient Greece, placed their gods at the head of their genealogical tree. The immigration of a colony of Aryan Brahmins from Magadha into the Madura country, and the commencement of Tamil civilization and literature, have been placed, by Mr. Caldwell and others, in about the seventh century B.C.

At the Christian æra the kings of Madura were very powerful, and had extended their dominions over the whole of the peninsula. They sent two embassies to Rome—the first in the eighteenth year after the death of Julius Cæsar, which found the Emperor Augustus at Tarragona; and the second six years later, when he was at Samos.[445] Subsequently the kingdom was reduced in size by the independence of Malabar, the rise of Chira in the west, of the state of Chola in the east, and of Ramnad in the south.[446] A long list of kings is mentioned in the native annals, with numerous wars, first against the Buddhists, and afterwards with the Rajahs of Chola and Ramnad.

The most flourishing period of Madura history appears to have been during the reigns of Vamsa Sekhara and his son Vamsa Churamani, in about 200 A.D. They erected grand temples and palaces, and the more ancient and massive parts of edifices still in existence probably date from their reigns. A college, called *Sangattar*, was founded at

Madura, at this time, for the cultivation of the Tamil language and literature.[447] The first stimulus was given to this movement by the famous *Rishi* or sage, Aghastya, the leader of a colony of Brahmins, whose migration to the south is mentioned in the Ramayana. He was a chief agent in diffusing the worship of Siva in the Deccan; and it is supposed that there was a second man of learning of the same name in the eighth or ninth century. Aghastya is said to have been the offspring of two gods, Mithra and Varuna, and he received the Brahminical string from seven holy prophets. He became a most wonderful and enlightened personage, and composed works on medicine, moral and natural philosophy, and botany, in high Tamil verse, called *Yellacanum*, greatly improving and refining his adopted language. Aghastya's memory is deeply venerated by the Tamil people, and his healing spirit is still believed to hover amongst the mountains of Courtallum, in Tinnevelly;[448] where he is worshipped as *Agast-isvara*, or the star Canopus.

From the ninth to the tenth centuries the Jain religion predominated in Madura. The Jains were animated by a national and anti-Brahminical feeling, and it is chiefly to them that Tamil is indebted for its high culture and independence of Sanscrit. They were expelled in the reign of Sundara Pandya, at about the time when Marco Polo visited India. The Mohammedans first made an inroad into the Deccan in the reign of Alla-ud-deen of Delhi in 1293, they crossed the Kistna in 1310, and advanced as far as Rameswara in 1374.

After reigning for many centuries the Pandyan dynasty became tributary to the powerful Brahminical kingdom of Bijayanuggur in Mysore, in about 1380 A.D. A list of more than seventy kings is given in the annals.[449] But in the fifteenth century an officer of the Bijayanuggur Rajah, named Nagama Naik, was installed as feudatory King of Madura, and founded the Naik dynasty. He procured the cession of Trichinopoly from the Chola Rajah, and his son Viswanath Naik distributed the district of Tinnevelly amongst his adherents of the Totia caste, the ancestors of the Poligars of Tinnevelly. His descendant Tirumalla Naik, who succeeded in 1623 A.D., had a long and flourishing reign, and public edifices still furnish splendid proofs of his wealth and magnificence. He died in 1657 A.D.; and the Naik dynasty, which came to an end in 1730 A.D.,[450] was followed by obscure feudatories of the Nawabs of the Carnatic, who eventually made way for British rule.

I went early one morning, with Mr. Levinge the Collector, to visit the great pagoda of Madura, some of the oldest parts of which date from the reigns of Pandyan kings in the eighth century. It covers twenty acres of ground, and is surrounded by a high stone wall painted in red and white stripes, the Hindoo holy colours. The walls form a perfect square, and in the centre of each side there is a lofty *gopuram* or tower. These towers are broad, solid, and very lofty masses of brick, in the form of a truncated pyramid. From the base to the summit they are one mass of sculptured figures, representing all the

gods in Hindu mythology, rising tier above tier to the summit, and decreasing in size with the height. Each end of the top of the *gopuram* is ornamented by a fan-shaped structure of brick-work, representing the hood of a cobra. We entered the pagoda by a gateway in the left corner of the wall facing the great *choultry* built by Tirumalla Naik. Here the warden of the pagoda was waiting for us, who had arrived just before in his palkee. He is of Sudra caste, a man advanced in years, and of much reputed holiness; and he received us in a state of nudity, with the exception of a yellow gauze scarf, his belly, chest, and forehead being smeared with holy ashes. A crowd of Brahmins accompanied us.

A long corridor leads from the entrance to the cloister, with a roof supported by stone pillars, between which elephants were stationed, gaudily painted and caparisoned. The cloister is the finest part of the interior of the pagoda. The walls are covered with paintings representing the marvellous adventures of Krishna, and the pillars supporting the roof of the galleries are roughly carved. The central space is occupied by "the tank of the golden lotus," with very dirty green water, and stone steps leading down from the cloister. The view from one corner of this tank is very striking; with green stagnant water as a foreground, rows of fantastically-carved pillars supporting the gallery on the opposite side, with the lofty *gopurams* in the rear, rising as it were from the graceful fronds of cocoanut-trees which waved over the roof of the cloisters. Sacred monkeys were running about in all directions over the roofs.

The *Sangattar* or literary college of Madura held its sittings in this cloister; and Siva is said to have presented it with a diamond bench which extended itself readily for such persons as were worthy to be on a level with the sages of the *Sangattar*, and excluded all who tried to sit on it without possessing the necessary qualifications. In other words, the learned corporation of Madura maintained a strict and exclusive monopoly. One day a man of the Pariar or lowest caste, named Tiruvallavar, appeared as a candidate for a seat on the bench of *Sangattar* professors. The sages were indignant at his presumption, but, as he was patronized by the Rajah, they were obliged to give his book a trial. It was to find a place on the bench, which the professors took care to occupy fully. But the miraculous bench extended itself to receive the book, which expanded and thrust all the sages off into "the tank of the golden lotus," and the *Sangattar* was abolished. This took place in about the ninth century, and the work of Tiruvallavar, called *kural*, and consisting of 1330 aphorisms, still exists, and is the oldest extant work in Tamil literature. Though rejected by the *Sangattar*, on account of the low caste of its author, it was received by the Rajah and people; and the college was abolished, or perhaps dissolved itself from mortification at this defeat.

In a corner of the cloister is the entrance to one of the *gopurams*, and we went up to the top. Holding on by the cobra's hood which crowns the tower, there was an extensive view of the town of Madura and surrounding country, with its bright green rice

cultivation, groves of palmyra-palms, broad expanses of water, isolated masses of rock, and the Pulney hills in the far distance.

We passed from the cloister, and walked round the corridors which surround the holy of holies containing the *Sokalinga*, the sacred emblem of the God Siva, which no one but a Brahmin can enter; and the temple of Minakshi, his fish-eyed wife. The pillars in these corridors are curiously carved in the form of dancing-girls, elephant-headed Gods, Sivas, and bulls. Here I was decorated with garlands of flowers by the warden of the temple, and I saw that there was a flower-garden in a small enclosure near the cloister, to supply offerings of flowers for the ceremonial worship in the temple. In the Hindu religion bright-coloured or fragrant flowers take a prominent place as offerings to the gods. The arrows of Kama, the God of Love, were tipped with five flowers:[451] the *asoka* (*Jonesia pinnata*), a beautiful flower diversified with orange, scarlet, and bright-yellow tints, is consecrated to Siva; the lotus-flower, called *kamata* or *padma*, to Vishnu and his wife Lakshmi; a sweet-scented jasmine (*Jasminum undulatum*) to Vishnu, and Mariama the Goddess of Pariars; the superb crimson *Ixora Bandhuca* is offered at the shrines of Vishnu and Siva; and the *Nauclea Cadumba*, a stately tree, yields the holiest flower in India.[452] In an angle of one of the corridors all the jewels of the temple were spread out on a table for our inspection, and we sat down before them, by the side of the old warden. It was a truly magnificent display of wealth; and it was impossible not to feel that there must be deep faith and conviction in a religion which induces men to go about naked and in ashes, and to devote tens of thousands of rupees to ornament the mystic emblems of their Gods. I particularly noticed some sapphires of extraordinary size and brilliancy; the cover of the *lingam*, a cylinder of pure gold, four feet high, encrusted with pearls and rubies; the golden sceptre of Siva, three feet long, and one mass of rubies; the golden shoes and gauntlets of Siva and Minakshi, inlaid with rubies, emeralds, and pearls; the head-dress of Minakshi of gold Trichinopoly-work, adorned with pearls and rubies, with enormous emeralds hanging from it; her playthings, consisting of golden birds overlaid with rubies and emeralds; and necklaces and bracelets covered with jewels of priceless value. There was also a costly gold chain presented by Mr. Peters, a former Collector, and another which had lately arrived from Agra, in an anonymous letter addressed to the pagoda.

From this corridor I was able to peep down a dark passage at the end of which there were some dim lights surrounding the sacred *Soka-linga*, but I could not distinguish anything. The warden told us that it was a piece of solid rock cropping out of the ground, and cut into the shape of a cylinder, with a rounded top, as the mysterious emblem of Siva, the God of reproduction. Its roots are said to be in the centre of the earth, and to have been there since the creation. The Pandyan kings, when they were dying, were taken into the innermost sanctuary of Siva's temple, to expire and be united with their God. Parallel with this holy of holies dedicated to the worship of Siva, in the

form of his mystic emblem, is the temple of his wife Parvati, here better known as Minakshi, or the fish-eyed.

We then went into the hall of the thousand pillars, which are carved into the shape of gods or dancing-girls, and support a flat stone roof. Here some nautch-girls came dancing before us in silk trousers, long tunics, golden headdresses, and rings on their ears, noses, and toes; as we walked down the long vistas of pillars. Their motions are stiff and without grace, like the contortions of galvanized corpses, and they are generally very ugly, with black teeth. I was glad when they relieved us of their disgusting presence, as we were shown into a chamber near the outer door, where the horses and bulls used in the great processions are kept. These are made of solid silver, ornamented with precious stones, and on festivals the God and Goddess are mounted on them, and carried round the town.

This great pagoda is very richly endowed, and is one of the most famous in Southern India. It was originally, and for several centuries, the centre of Tamil civilization, and it is a very characteristic specimen of Hindu architecture. All originality and intellectual vigour has disappeared from amongst the Tamil people, under the blighting influence of foreign domination, but their devotional feeling appears to have survived; together with respect and veneration for the doctrines and aphorisms of their classic sages, among the more educated. Aghastya stands at the head of the Tamil authors, and the following confession of faith, in the *Njana-nuru* is attributed to him:—

> "Worship thou the light of the Universe, who is One:
> Who made the world in a moment, and placed good men in it;
> Who afterwards himself dawned upon the earth as a Guru;
> Who, without wife or family, as a hermit performed austerities;
> Who, appointing loving sages to succeed him,
> Departed again into Heaven:—worship Him."[453]

We left the pagoda by a corridor leading through one of the *gopurams* into the street, immediately in front of the great choultry erected by Tirumalla Naik. It consists of an immense hall of granite, 300 feet long by 80, supported by upwards of a hundred pillars of the same stone, elaborately carved, and about thirty feet high. One of them is formed of a single block of granite. Figures of the Madura kings of the Naik dynasty are carved on these pillars, amongst whom is Tirumalla Naik, the founder of the edifice. One curious group of carved figures represents a tradition of the old Pandyan times. It is related that a rich farmer, living near Madura, had twelve sons, who passed their time in the chace. A wild hog once attacked them, killed some, and chased the rest to the vicinity of a sage engaged in meditation. The angry ascetic cursed them, declaring that, in their future life, they should be hogs themselves. They were born again as porkers, but Minakshi took pity on them, officiated as their nurse, and they became men with

pig's heads, in which capacity they are sculptured on one of the pillars of the choultry. The pig-headed brethren were taught the arts and sciences, and were eventually advanced to the ministerial administration of the affairs of the Pandyan kingdom. The choultry was originally built as a magnificent approach to the temple, and to receive the image of the God Siva for ten days every year. It was crowded with people, and the spaces between the pillars were occupied by traders selling silks and cotton-cloths, turbans, bags for betel, and trinkets.

Next to the great pagoda and the choultry, the most interesting architectural remains of the former grandeur of Madura are the ruins of the palace of Tirumalla Naik. They consist of a large quadrangular court, now roofless,[454] but apparently once covered over, with side aisles supported by massive stone pillars, rendered almost double their original size by a thick coating of *chunam*, or lime made with pounded sea-shells, which takes a very fine polish, like marble. These columns are exceedingly handsome, and their capitals bear evidence of Italian design.[455] They are in double rows, and the roof of the aisles is most elaborately carved with mythological figures, originally painted in bright colours. Numerous green paroquets were screaming and flying about near the roof. At the end of this splendid court, opposite the street entrance, there is a broad flight of steps leading up to an inner hall, where columns of the same massive character support a richly carved roof. The whole building has an exceedingly imposing effect, and in the sombre melancholy of its decay it gives a grand idea of the former civilization of the Tamil people; but as the English Judge now holds his court in a portion of the ruins, we must not say, with the Persian poet,—

> "The spider now weaves its web in the palace of Cæsar,
> The owl stands sentinel on the watch-tower of Afrasiab."

Tirumalla Naik also constructed a great tank, about a mile outside the town, said to be the finest in Southern India. It is an exact square, with sides 300 yards long faced with granite, and flights of steps down to the water, at intervals. In the centre there is a square island, rising in broad flights of steps from the water, and covered with a grove of trees, above which rises the tall tower of a pagoda.

The town of Madura, situated on the banks of the river Vaigay, contains about 50,000 inhabitants. It is by far the cleanest and best built city that I saw in India, with fine broad streets, and houses with tiled roofs extending far beyond the walls, so as to form verandahs supported by poles. Here and there a house with an upper story, belonging to some wealthy citizen, rose above the rest; and in the bazars there was a strong sickly smell of spices. Madura is indebted, for its superiority over other Indian towns, to Mr. Blackburn, a former Collector, and the inhabitants have erected a lamp on a tall pedestal to his memory.

On the day of my visit to the pagoda, the streets were densely crowded, the women were decked out in all their finery, and those of the Brahmin caste had their faces hideously stained with saffron. It was a festival in honour of some cow or other, who had been turned into a rock, through the excess of her love for *Nandi*, the bull on which the God Siva rides. The religious feelings of the people are displayed in these festivals, and whether they worship and venerate the stone or wooden image, or the attributes of God-like virtue and wisdom which the emblems connected with the image are intended to represent, my observations led me to believe that, in all classes, there was a display of most undoubted sincerity. In connection with their religious observances, the people of Southern India feel very strongly on the subject of caste distinctions. The Brahmins are fair skinned, of Aryan descent, and comparatively strangers, having been barely a thousand years in the country.[456] Next come the *Sudras*, who represent the upper classes of the Tamil race. The *Vellaler* or agricultural caste comes next, and then the *Maravar* and *Kallar*, or robber castes. The Prince of Ramnad, who is hereditary guardian of Rama's bridge, belongs to the Maravars, and the Rajah of Tondiman to the Kallars. Below the robber castes are the *Shanars* or toddy-drawers, who are free and proprietors of land; then the *Pariars*[457] and chucklers or slaves; then the *Korawars* or vagrant basket-makers, and last of all the shoemakers and low-caste washermen.

The higher castes had recently been outraged by the Shanars having been allowed to go in procession along the road, on the occasion of a marriage at Arpucaté, a populous mercantile town in the Madura district. This was done in defiance of all ancient customs and usages connected with caste, which are clearly defined and acknowledged by all classes of Hindus. The high-caste people defend their feeling of exclusiveness by urging that the Shanars and Pariars are guilty of one or other of the five great sins, namely, killing the sacred cow, theft, drunkenness, adultery, and lying: for that the Shanars draw toddy, and the Pariars eat meat. They claim for immemorial custom the same authority that is given in England to common law, and declare that the Shanars never had the right of parading the streets in procession, with music and flags. In considering this question it should not be forgotten that the Shanars and other low castes will no more allow a man of still lower caste to overstep his privileges by one hair's breadth than will a Sudra or a Brahmin. Even the Pariars are a well-defined, distinct, and ancient caste, jealous of the encroachments of the castes both above and below them: they have strong caste feelings, and treat the caste of shoemakers with contempt.[458] Thus, if the Shanars and Pariars insist upon their own caste privileges, it is difficult to see why they should be permitted to infringe upon those of the castes above them; and it would seem that a feeling of content and satisfaction with our rule would be best promoted by ensuring to all classes of the community the exclusive enjoyment of their own peculiar usages and privileges.

Caste is one among many instances of the peculiar exaggerations in which the Hindu mind loves to indulge. The social distinctions which prevail in other countries are represented in India by this institution, in which those distinctions are, not altogether illogically, carried to an extreme point. Caste may be modified and rendered less harsh in its general outline; but it will never cease to exist. The Protestant missionaries, of course, declare war to the knife against it, as a system of falsehood and deceit, and an absurdity contrary both to reason and revelation. This may be true, as well as that Brahmins get drunk, and eat asafœtida-cakes in which buffalo flesh forms an ingredient, without losing their caste; but missionary denunciations of caste absurdity, and exposures of Brahminical irregularities, are not likely to make the slightest impression on the minds of a people with whom caste distinctions are hallowed by immemorial usage, and bound up in every act of their lives. The favourite missionary receipt is, therefore, to deprive Brahmins of their *Enam* or rent-free lands, to induce Government entirely to disavow caste, to put an end to all caste distinctions in jails, and to raise the Pariars and Chucklers from their degradation.[459] A very summary plan no doubt, but as impracticable as it would be impolitic and unjust.

After a most delightful visit at Madura, I started for Trichinopoly late one night, and found the road so execrable in some places, that it was necessary to go off into the fields, and make a long circuit. The country between Madura and Trichinopoly is chiefly cultivated with dry grain, but there are occasional patches of rice. Ranges of rocky hills intersect the plain, covered with underwood and low trees, which the natives are allowed to use for firewood, but, when they carry it off for sale, in cart-loads, there is a small duty. I walked most of the distance under the shade of the peepul and banyan-trees which line the road, and reached Trichinopoly after a journey of a day and two nights.

Trichinopoly is a large military station, and the European houses, therefore, are very numerous, and occupy a considerable space, as they are generally surrounded by large parks or compounds. A bridge over a small tributary of the Cauvery leads to the bazar and native town; and the view from the bridge is very pretty, with cocoanut-trees and bushes coming down to the water's edge, and houses embosomed in trees, whence flights of steps lead down into the water. Beyond the bridge there is a picturesque mosque of white stone, and the bazar, a long street leading to the principal part of the town, in the centre of which the famous rock of Trichinopoly rises up abruptly. Brahmins and other traders were sitting in their shops, before piles of earthenware and copper chatties, cotton cloths, and numerous kinds of grains and pulses in baskets. The rock is a mass of granite, 400 feet high, crowned by a small Hindu temple; the ascent is cut in steps out of the solid rock, and from the summit there is a most extensive view, including the city, the fine bridges over the Coleroon and Cauvery, the *gopurams* of the great pagoda of Seringam on an island in the river, and a vast expanse of rice cultivation and palm-groves, with Tanjore on the distant horizon. The native town contains several

large handsome houses belonging to Mohammedans, and the ruins of the palace of the Nawabs of the Carnatic.

Through the kindness of Mr. McDonnell, the Collector, I was enabled to pass a very interesting day at the Upper Coleroon *anicut*. Passing the base of the rock of Trichinopoly, and following the main street of the native town, the banks of the river Cauvery are reached, where there are rows of stone temples and houses with open corridors, whence flights of steps lead down into the water. Near the river there is a tank filled with red and white lotus-flowers. A handsome stone bridge spans the Cauvery, and another of equal length crosses the Coleroon, about a mile further on. The two rivers form an island, and unite a few miles lower down; and the upper *anicut* is about fourteen miles up the river, where Mr. McDonnell had a comfortable bungalow on the banks, shaded by lofty trees.

The Upper Coleroon *anicut* or weir is constructed at the west end of the island of Seringam, which is formed by the separation of the Cauvery into two branches, namely the Coleroon on the north, and the Cauvery on the south. Formerly the bed of the Coleroon was continually deepening, while that of the Cauvery was rising, so that there was much difficulty in obtaining a sufficient supply of water for the irrigation of the rice-fields of Tanjore. The upper *anicut*, commenced by Colonel Cotton in 1836, and finished in 1850, completely answered the purpose of deepening the bed of the Cauvery, so much so that another weir was made across that river, sixty miles lower down; and by means of the second weir, made in 1845, and the under sluices in the upper one, the water is now effectually kept under command.[460] The upper *anicut*, which I visited, is broken into three parts by two small islands. The south part is 282 yards long, the centre 350, and the north 122, the whole length, including the islands, being 874, and without them 754 yards. The weir is a plain brick wall, plastered with *chunam*, six feet thick, and seven feet high, the top being lined with masonry. It is defended from the overfall by masses of rough stone; and there are twenty-four sluices, which prevent accumulations of sand from forming above the *anicut*. The sluices are connected by a narrow bridge of sixty-two arches, to secure access to them during floods, and it also serves as a means of communication between the banks for foot passengers. The cost of the work, and of repairs between 1836 and 1850, was two lacs of rupees, and it assists the irrigation of 600,000 acres, yielding a revenue of 400,000*l*., or equal to two-thirds of that of the whole island of Ceylon.

By means of these *anicuts* the fertile province of Tanjore is converted into one vast rice-field,[461] and the portion of Trichinopoly below the upper weir is equally rich. The country to the north of the road between the *anicut* and the town of Trichinopoly was a wide expanse of bright green rice cultivation, stretching to the horizon. In Southern India there are two annual crops of rice, called the *caar* and the *soombah* or *peshanum* crops. The former is reaped in October and is reckoned inferior, and the latter in February and

March. Two crops in the year from the same land do not yield much more than a single crop, but, owing to the liability of the seasons to fail, the cultivators rear as much as possible for the first crop. This is reaped in the rainy season, when the straw cannot be preserved, so that the second crop must necessarily be sown, for fodder for cattle. Rice requires rain to ensure the full development of the grain, as well as irrigation. The seed is sown thick, and then transplanted to the fields about forty days afterwards; and the fields must be constantly supplied with water. The stalks when cut are stacked for a few days, and the grain is then thrashed out by manual labour or cattle, the husk being separated from the grain with a rice-stamper, generally beaten by women. In the interval of sowing, the natives often sow the land with pulse or sesame, the stubble of which is used as manure for the next rice-crop.

At intervals scattered over the plain, there are groves of cocoanut and palmyra-palms, like islands in the vast sea of rice-fields, with small villages built under their shade. As the betel-nut palm is the most graceful in India, so the palmyra (*Borassus flabelliformis*) is undoubtedly the ugliest, with its black stem the same size all the way up, and coarse fan-shaped leaves. It is chiefly from this tree that the Shanars draw the toddy. The spadix or young flowering branch is cut off near the top, and an earthenware *chatty* is tied on the stump, into which the juice flows. Every morning it is emptied and replaced, the stump being cut afresh, and so on until the whole is exhausted. Sugar is also extracted by the same process, the inside of the *chatty* being powdered with lime to prevent fermentation, and the juice being boiled down and dried. The sugar thus obtained is called *jaggery*. The timber of the palmyra-palm is extensively used for building.

As we drove towards Trichinopoly, with these rice-fields studded with palm-groves on our right, the tall towers of Seringam[462] appeared rising above the trees which border the waters of the Cauvery; and near the town there are large plantain-groves. In leaving Trichinopoly on the road to the Neilgherries it is necessary to cross a small affluent of the Cauvery in ferry-boats. Those for foot-passengers are of wicker covered with hides, and perfectly round, like those which are described by Herodotus, and are still used on the Tigris and Euphrates. After jolting all night through endless groves of banyan and peepul trees, I reached Caroor,[463] the ancient capital of the Chira Rajahs, the following morning. The Chira state, in the days of its prosperity, extended over Coimbatore, and part of Mysore and Malabar. Caroor is a town of some size, in the middle of a plain, through which flows the river Amaravati, a tributary of the Cauvery. Mr. Roberts, the Sub-Collector, was living in a curious upper story, on the top of a pagoda, the entrance to which leads under a tall brick *gopuram*, 86 feet high, 64 feet long at the base, and 52 feet broad, sculptured with images exactly on the pattern of those at Madura. The country between Caroor and the foot of the Neilgherries is flat and uninteresting, chiefly cultivated with *cholum*, *cumboo*, cotton, and a few pulses, with rice in some places. The road is execrable, and generally lined with banyan-trees, which, though affording

pleasant shade, are ungainly and ugly, owing to the numerous bunches of dusty-looking roots, which hang in all directions from the branches. On arriving at Matepoliem I found a pony waiting, and, riding up the Coonoor ghaut, returned to Ootacamund. Half-way up the ghaut, at a place called Burlear, Mr. Thomas, the Collector of Coimbatore, has a small but interesting garden, containing all kinds of spices, cacao, coffee and tea plants, besides oranges, lemons, and citrons.

During my tour through the principal Tamil districts I was chiefly struck with the evidences, furnished by the pagodas of Madura and Seringam, and the works of Tirumalla Naik, of the great surplus revenue which was once derived from the land. By the execution of additional public works, the improvement of means of communication, and judicious reductions of the land-tax, which will induce the ryots to bring more waste land under cultivation, much has been effected, but much still remains to be done, before the country attains the same degree of prosperity which it appears to have enjoyed in the best days of the Pandyan and Naik dynasties. Tanjore has probably already reached the highest state of profitable rice cultivation, through the irrigation supplied by the Coleroon *anicuts*. But much may yet be done with regard to the encouragement of the growth of cotton in Coimbatore, Madura, and Tinnevelly; and hereafter the coffee and chinchona plantations of the Neilgherry hills, the Pulneys, and the Anamallays will supply another important source of wealth and prosperity.

To the north of the Cauvery, in the district of Salem, there is a range of isolated hills, called the Shervaroys, which rise, a few miles north-east of the town of Salem, into a mass of densely wooded flat-topped hills. The mean height of the table-land of the Shervaroys, on their summits, is 4600 feet, and the highest peak rises to 5260 feet. In the Salem district the south-west monsoon sets in early in June, and showers continue till September; and in the end of October the north-east monsoon brings a return of rain from the opposite quarter, which continues until December, when the rains cease, owing to the change of wind from north-east to due north. There are several coffee estates on the Shervaroy hills, but they are considered to be too dry, and, although the coffee produced is said to be of excellent quality, yet the yield is small, and I was told that the Shervaroy plantations were generally losing concerns. The land-tax on these estates is one rupee an acre. Between December and June it is exceedingly dry, and I, therefore, did not consider it advisable to try the experiment of chinchona cultivation on the Shervaroys during the first or second years. If the plants are hereafter found to be capable of enduring longer droughts than we at present expect, they may then be tried on the Shervaroys.

For the same reason I gave up all idea of the hills near Courtallum, in Tinnevelly. At Courtallum, notwithstanding the perennial humidity, the rainfall is only 40 inches, though on the surrounding hills it is probably greater.[464] The elevation of those hills, however, is not sufficient for the profitable cultivation of most species of chinchona-

plants. Tinnevelly is sheltered from the south-west monsoon by the Travancore mountains, and from the north-east monsoon by the Serumullay hills, 3500 feet high, which rise from the Madura plains near Dindigul, and by the island of Ceylon to the east. This extreme south part of the peninsula, between latitude 8° and 10° north, therefore receives little moisture, and has a hot arid climate, resembling Egypt, and producing senna and Indian cotton of the best quality.[465] It is possible, however, that localities may hereafter be found, where the chinchona species suited to comparatively low elevations might flourish, such as *C. succirubra* and *C. micrantha*, on the mountains dividing Tinnevelly from Travancore.

CHAPTER XXVI.

MYSORE AND COORG.

Seegoor ghaut—Sandal-wood—Mysore—Seringapatam—Hoonsoor—The tannery—Fraserpett—Mercara—The fort—The Rajahs of Coorg—The Coorgs—Origin of the river Cauvery—Coorg—Climate—Coffee cultivation—Sites for chinchona-plantations—Caryota Urens—Virarajendrapett—Cardamom cultivation—Kumari—Poon, blackwood, and teak—Pepper cultivation in Malabar—Cannanore—Nuggur and Baba Bodeen hills—The Beebee of Cannanore—Compta—Sedashighur—Arrive at Bombay.

THE descent from the plateau of the Neilgherries to the plains of Mysore on the north, is by the Seegoor ghaut, the only one which is practicable for carriages. It is much tamer, and not to be compared with those of Sispara or Coonoor; and at the foot there is a wide belt of thin, stunted, pestiferous jungle, twenty-five miles in breadth, through which the river Moyaar flows to join the Bowany. There are a great many young teak-trees, and sandal-wood is also found, in the forests on the inner or eastern slopes of the ghauts; but all the timber looked poor and stunted.[466] The sandal-wood tree (*Santalum album*) is about twenty feet high, with numerous spreading branches, and small purplish flowers. Dr. Cleghorn reports that with vigilant supervision, and slight assistance to nature in clearing the heads of young plants, which are often matted down by creepers, an addition might accrue to the revenue of several districts in the Madras Presidency by the sale of sandal-wood. The export trade in sandal-wood and oil is even now very considerable. The road from the foot of the Seegoor ghaut to Mysore, a distance of sixty-four miles, is excellent, and there is a very good bridge over the river Moyaar. We passed the night at the half-way bungalow of Goondulpett, whence there is a grand view, with scattered date-palms in the foreground, a vast expanse of undulating plain beyond, bounded by the belt of forest, with the blue line of the Neilgherries in the distance. There is nothing of interest between Goondulpett and Mysore.

Mysore is on a table-land 2450 feet above the sea. On the western side of the town flows the Purneah canal, which comes from a distance of seventy miles to supply Mysore with water, and was made by the Brahmin minister Purneah, who came into power during the present Rajah's minority, after the death of Tippoo. In approaching the town, the isolated rocky hill of Chamandi is seen on the right. Mysore is fortified, and, after passing under the ramparts, we entered a square, one side of which is occupied by the Rajah's palace. Here, and in the adjoining streets, there was an unusual amount of life and bustle owing to the presence of a native court; and we met crowds of nautch-girls, men in various costumes, elephants, camels, and bullock-carts. Some of the houses have upper stories, but the majority are dark places, with red-tiled roofs extending far over, and forming verandahs.

Mysore is so called from its having been the abode of the buffalo-headed demon *Mahesh-asur*, who was slain by Parvati, the wife of Siva, in her most hideous and repulsive form, as Cali, the impersonation of vengeance. The country, from 1336 to 1565, formed a part of the Brahminical kingdom of Bijayanuggur; and in 1576 one Raj Wadeyar established his independence as ruler of Mysore, from whom the present Rajah is descended. After the death of Tippoo Sultan, and the capture of Seringapatam by the English in 1799, the present Rajah, then only five years old, was placed on the throne, and the country was ruled by his very clever minister Purneah, until he came of age. He afterwards proved so utterly incompetent to govern, that the country fell into a state of anarchy, and the English therefore undertook the administration in 1832. The Mysore Commission was then formed, with Sir Mark Cubbon at its head, and Mysore was divided into four divisions—Bangalore, Astagram, Nuggur, and Chitteldroog.

The table-land of Mysore covers an area of 30,886 square miles, and contains a population of 3,300,000 souls. Sir Mark Cubbon's administration was vigorous and progressive. In 1832 the revenue was 440,000*l.*, in 1860-61 it was 950,000*l.*, and in the latter year there was an excess of income over expenditure, amounting to 120,000*l.* The Chief Commissioner has made upwards of 1600 miles of excellent carriage-road, bridged throughout, and has introduced many important measures, while the officers who have worked under him have generally been distinguished for ability and zeal. The good old general was sixty years in India, and governed Mysore from 1832 to 1861. He was adored by all ranks of the people, and his resignation caused universal regret, when, early in 1861, he sailed for England. But he was not destined to see his native land again, he died at Suez, and thus passed away a brave soldier and an enlightened statesman, one who had done as good and valuable service to his country as any English public servant during the present century.

During our stay at Mysore we drove over to Seringapatam, a distance of twelve miles. The immediate neighbourhood of the capital is chiefly planted with dry grains, such as raggee and pulses. The common people live chiefly on raggee, which they store in underground pits. They also use the seeds of gram (*Cicer arietinum*) in curries and cakes, and the oxalic acid which exudes from every part of the plant serves instead of vinegar for their curries. The roads round Mysore are lined with hedges of American aloe. After the first few miles, we began to pass through groves of cocoanut and betel-palms,[467] much rice cultivation, and fields of sugar-cane. Close to Seringapatam a sugar manufactory has been established by Mr. Grove, who buys up the *jaggery* from the ryots and refines it. We crossed the Cauvery by a fine bridge, and saw the great canal constructed by Tippoo for irrigating the rice-fields. There are large ruinous houses and temples, embowered in palm-trees, with flights of steps down to the river, outside the old town itself, which is surrounded by a wall and ditch.

We first drove to the tomb under which Hyder Ali and Tippoo are buried. It is in the middle of a garden called the *Lal-bagh*, with a pretty avenue of cocoanut and betel-palms leading up to it. The tomb is a square building, surmounted by a dome, with minarets at the angles, richly decorated with arabesque-work in *chunam*. It is surrounded by an open corridor, supported by pillars of black hornblende, and in the centre of each side there is a doorway. That facing the avenue is filled in with an open-work screen of the same stone, and the others have double doors richly inlaid with ivory, the gift of Lord Dalhousie. The tombs are placed under the dome, three in number, namely, of Hyder, Tippoo, and Tippoo's mother, each covered over with a pall of crimson silk. The building is surrounded by cloisters, a part being used as a choultry for Moslem travellers, another as a mosque, and another as a school for small boys who learn to read the Koran. Government grants an allowance for keeping the place in repair, and paying Moulvies to serve in the mosque. The effect of the snow-white tomb, richly adorned with arabesque-work, the lance-like minarets, the cloudless sky, and the feathery palm-trees rearing their graceful heads round the building, was exceedingly like a scene in the Arabian Nights. The tomb of Colonel Baillie, who was taken prisoner by Hyder Ali in 1780, is close by, but in a very neglected state.

We then went to the *Derya Dowlet-bagh* close to the town, which was the favourite summer-palace of Tippoo. It is a very richly ornamented arabesque building, every part being covered with gilding and bright colours, and pictures on the walls representing the repulse of Lally, and the defeat of Colonel Baillie. From this place we went to the town of Seringapatam itself, which is built on an island in the Cauvery, and surrounded by a strong wall and two very deep ditches. Close to the gate is the *jumma musjid*, or principal mosque, with two tall minarets; and, in one corner, the spot was pointed out where Tippoo was accustomed to pray, entering the mosque by a small side-door. The double ditch is a very formidable defence to the town, but it does not extend along the side facing the river, and it was here that the assault was delivered by the English general. A feint was made in the direction of the *Lal-bagh*, where the English suffered severely, while the real storming party was formed on the opposite side of the Cauvery, at a spot which is now marked by two upright posts. A bastion facing the river had previously been breached, the four guns on it dismounted, and scarcely any other guns could be brought to bear on the soldiers of the assaulting column at this particular point, who dashed across the Cauvery and up the breach. Tippoo was jammed by the flying crowd in a small doorway, which we saw, where he was killed, and from that day the pestiferous Seringapatam ceased to be the capital of Mysore. The palace, now in ruins, is very like that of the Nawab of the Carnatic at Trichinopoly, a plain rambling building with rows of large windows, and there are extensive gardens round it, full of tamarind-trees, cocoanuts, plantains, and vines.

The old town of Seringapatam is exceedingly interesting, but it now wears an appearance of silent decay and desolation. It is notoriously unhealthy, and the inevitable

penalty of a night passed in the town is a severe attack of fever.

From Mysore we took our way, by Hoonsoor, to the hill district of Coorg. The road to Hoonsoor passes over twenty-eight miles of a country very little cultivated, with extensive tracts of waste land, and a few fields of dry grain near the villages. Hoonsoor has for many years been a Government grazing-farm and manufactory. In 1860 the bullocks were all sold off, but there are still thirty-eight fine elephants, and upwards of a hundred camels. We saw the elephants having their breakfasts in a solemn motionless row, large heaps of rice wrapped in bundles of reed being put into their mouths by the mahouts. Besides an establishment of blacksmiths, carpenters, brass-workers, and of women employed in making blankets, there is an extensive Government tannery at Hoonsoor. There are many trees in India well adapted for tanning purposes, but the American sumach (*Cæsalpinia coriaria*) introduced by Dr. Wallich in 1842, and called by the natives *divi-divi*, appears to be considered the best at Hoonsoor. The *kino*-tree (*Pterocarpus marsupium*) is another, and there are two kinds of *catechu* used for tanning, one from the betel-nut-palm, and the other from an acacia. To obtain the *catechu* from the betel-palm the nuts are boiled, and the remaining water is inspissated, and yields the best kind, which is used for the golden coffee-brown colour in dyeing calico, as well as for tanning. From the acacia the *catechu* is obtained by boiling the unripe pods and old wood. It is not considered so good as *kino* or *divi-divi* for tanning purposes, on account of its extreme astringency. The tannery at Hoonsoor is a very extensive establishment, where shoes, sandals, crossbelts, and scabbards are made for the army.

This place suffers frequently and most severely from cholera; and, during these terrible visitations a *Swami* or God, in the shape of a small stone image of Ganesa seated under a black-wood tree, is specially invoked.

Hoonsoor is 25 miles from Fraserpett, at the foot of the Coorg mountains, and we passed through extensive groves of palm-trees with chatties fastened round the spadices to catch the toddy. Fraserpett is within the Coorg district, and it is in the pleasant little bungalows which have been built here, that the English take refuge during the heavy down-pour of the south-west monsoon. Through the kindness of Captain Martin, a former Superintendent of Coorg, and now engaged in the cultivation of coffee, we found horses waiting for us at Fraserpett, and continued our journey to Mercara, the capital of the district.

After the first two miles the road enters a dense bamboo jungle, extending along the base of the mountains. It was the month of January and the forest was completely dried up and burnt by the sun and want of rain, looking brown and sombre. A splendid white *Ipomœa*, with a rich lilac centre, was creeping in festoons to the very top of the feathery bamboos which bent gracefully over the road. At a place called Soonticoopah, ten miles from Fraserpett, the ascent of the mountains begins. The road leads up and down a

succession of wooded heights, which gradually increase in elevation, with intermediate valleys cultivated with rice and generally fringed with plantain-groves, through which the huts of the Coorgs are visible. At the heads of these valleys the streams are divided into two channels, and led down each side, the space between being sown with rice in terraced fields, gradually descending with the slope of the valley. These bright patches of cultivation are very pretty, with their light vivid green contrasting with the sombre hues of the forest. Near Mercara the jungle is a good deal cleared, and the slopes are covered with coffee-plants. The road is excellent.

Towards evening we came in sight of Mercara, by far the prettiest place I have seen in India. On the opposite side of a deep narrow valley was the fort and palace, built on an eminence overlooking a vast extent of mountainous, forest-covered country. The palace is surrounded by a fortified wall of dark-coloured stone, with semicircular bastions at intervals. On the wall facing us were two square buildings, with a row of long windows, and an overhanging roof, the residence of Captain Eliott, the Superintendent of Coorg; and behind rose up the long edifice forming the old palace, and the white steeple of a modern church. A range of wooded hills, with heavy clouds hanging over them, formed the background. To the right, at a lower elevation were the native town, and two mosque-like buildings, snowy white, with domes, and minarets at the angles, rising up amongst a grove of trees. These are the tombs of the former Rajahs. The narrow gorge below the fort is planted with coffee and plantains, which almost hide the huts that nestle amongst them. In the bottom of the ravine is the principal pagoda of Mercara, built like a mosque, with the tops of the minarets richly gilded. The entrance to the fort is by a steep ascent, leading under a deep gateway in the outer line of fortification, into a courtyard. A second archway leads into a second small court, where there is an elaborately carved pagoda to Ganesa. A third archway opens upon the principal courtyard of the fort, one side of which is occupied by the Rajah's palace, a long barrack-looking building, with an upper story and projecting tiled roof. The officers of a native regiment are quartered in the palace. To the left is the English church, and to the right there is a dark dungeon under the rampart, where the late Rajah kept his prisoners. He used to allow one at a time to run out, and try to escape by the archway, while he picked them off with a rifle from a window of the palace as they ran. There are two full-sized models of favourite elephants, built of brick and *chunam*, in the courtyard. The huts of the native regiment are clustered in a little valley close under the south wall of the fort.

The palace is entered by an archway, over which there is a balconied window supported by two white horses. The inner court is surrounded by a corridor of stone pillars, with a roof entirely of copper; and in the centre of the court there is a tank paved with stone flags, now dry, with five steps down to it, on two sides, and a carved stone tortoise in the centre.

On the other side of the small valley filled with soldiers' huts, there is a parade-ground, and a small amphitheatre dug out of the solid rock, where elephants and tigers fought for the diversion of the Rajah. Beyond the parade-ground the ridge on which Mercara is built abruptly terminates, and the land sinks down into a wooded valley. Here the late Rajah had built a little brick and *chunam* summer-house, whence the land descends precipitously to the road leading down the Mangalore ghaut. From this point there is one of the most glorious views to be found in India, and we could sit on the grassy edge of the cliffs for hours, without ceasing to enjoy it. Right and left there is a wide expanse of forest-covered ranges of mountains extending into the blue distance, and in front rises up the mountain of Tadiandamol, the loftiest peak in Coorg. We watched the crimson sunset over the hills, and after dark a spontaneous ignition of the dry grass wound like a serpent along the loftier ridges of the opposite mountains, producing an indescribably beautiful effect in the clear starry night.

Coorg has been a portion of the British dominions since 1834, when the last Rajah was deposed. The old Rajahs were not Coorgs, but Hindu Lingayets, a peculiar sect whose members wear a small god round their necks, in a little silver coffer.[468] The family had certainly reigned in Coorg since 1633; and Dodda Virappa, who died in 1734, fixed the seat of government at Mercara, and was the greatest prince of his family. He repulsed a simultaneous invasion of the Mysore Rajah and the Nairs of Malabar, and afterwards reigned in peace for eighteen years. Hyder Ali invaded and overran the country several times, but in 1788 the young Rajah Viraraja rallied the people round him, disputed every inch of ground against Tippoo's invading army, and made an alliance with the English in Malabar. On the fall of Tippoo a treaty was signed between the East India Company and Viraraja of Coorg, who died in 1807, leaving the country to his favourite daughter Devammaji. His brother Lingaraja, however, usurped the throne. He was a monster of cruelty, and, dying in 1820, was succeeded by his still more brutal son Viraraja, who massacred all his father's friends, together with the poor young princess Devammaji. Her sister, who had married a Coorg, escaped into British territory. It would be too revolting to recount all the atrocities of the last Rajah of Coorg; but at length the patience of Lord William Bentinck was exhausted, and in April 1834 General Fraser entered Mercara, and deposed him. Coorg has since been governed by an English Superintendent, under the orders of the Commissioners of Mysore.

The Kodagas or Coorgs are a tall, muscular, broad-chested, well-favoured race of mountaineers, numbering about 25,000, with a population rapidly increasing since the deposition of the Rajah.[469] They are of Dravidian origin, and speak a dialect of Canarese; but a colony of Brahmins early settled in the country, and endeavoured to mould the traditions of the Coorgs into harmony with their own legends. These are embodied in the Cauvery Purana, where there is a romantic account of the origin of that important river, which rises in the mountains of Coorg.

In the Mahabharata it is related that the *amrit* or drink of immortality, which had been lost in the waters of the Deluge, was recovered by the Suras and Asuras, gods and demons, by churning the ocean. The Asuras are then said to have stolen it, and it was finally restored to the gods by the maiden Lopamudre, who charmed the Asuras by her beauty. The fair damsel then resolved to become a river, and thus pour herself out in blessings over the earth. But the sage Aghastya, so famous in the history of Madura, was enamoured of her, and she at length so far yielded as to consent to be his wife, on condition that she should be at liberty to forsake him the first time he left her alone. One day he went to a short distance to bathe, when Lopamudre immediately gratified her early longings, by jumping into Aghastya's holy tank, and flowing forth as the river Cauvery. The sage, on his return, ran after her, but the only consolation that was left to him was to explain to his beloved the course she ought to take in flowing towards the eastern sea.

The Cauvery Brahmins, as persons of that caste are called in Coorg, wear the sacred thread, and perform *poojah* to Amma, the goddess of the river. They number about forty families, but are fast dying out. They are often very rich, and are employed in the pagoda, or as clerks in the Superintendent's office. The Coorgs themselves, the inhabitants of this mountainous district, are divided into thirteen castes.[470] They generally retain the old devil-worship of the Scythic or Dravidian race from which they are descended, and are addicted to the use of charms and sorceries. They marry at a ripe age, but the wives of brothers are considered as common property. All the men wear a silver-mounted dagger, secured round the waist by a silver chain; and the women, who are often very pretty, wear a white cotton cloth round the head, with the ends hanging half-way down the back. The men are an independent, hard-working race, tall, with comparatively fair skins. They are very keen sportsmen, and most of them possess a gun, the boys practising with pellet-bows.

Coorg consists of a succession of lofty wooded ridges and long deep valleys, forty miles broad by sixty long, between lat. 12° and 13° N. It is bounded on the north by the river Hemavati, on the south by the Tambacheri pass, on the west by Malabar and South Canara, and on the east by Mysore. South of Mercara the country appears covered with forest, wave upon wave of wooded mountain ranges rising one behind the other, the highest peak of all having its summit partially bare of trees, and covered with rich herbage. The elevations above the sea are as follows:—

Tadiandamol (the highest peak)	5781 feet
Pushpagiri (another peak)	5682
Mercara	4506
Virarajendrapett	3399
Fraserpett	3200

The river Cauvery drains about four-fifths of the surface of Coorg, while about a dozen streams, issuing from the same hill region, traverse Malabar and South Canara. From the end of December to the end of March rain is very scarce, but the valleys are seldom without fogs more or less dense in the evenings and mornings, and heavy dews are frequent. During these months a dry east wind prevails, which has long ceased to carry rain with it from the Bay of Bengal. Towards the end of March clouds begin to collect, and the air grows moister. In April and May there are thunderstorms and frequent showers, with a warm and moist climate. In the end of May the clouds in the western sky grow in strength; and in June rain prevails, descending at times softly, but generally with great violence, accompanied by heavy gusts of westerly wind. In July and August the rain pours down in floods day and night, to such a degree that a flat country would be deluged, but Coorg, after being thoroughly bathed, sends off the water to the east and west by her numerous valleys. The yearly fall of rain often exceeds 160 inches. In September the sun breaks through, in October a north-east wind clears the sky, in November showers fall over Coorg, being the tail of the north-east monsoon, and December is often foggy.[471] The following table will give an idea of the annual temperature of Mercara,[472] the extremes ranging from 52° to 82°, and the average being 60°:—

Mercara, the Capital of Coorg 1836-37.				
MONTH.	Mean Temperature.		Rainfall in Inches.	Prevailing Wind.
	6 A.M.	10 A.M.		
January	56	69	None.	N.E.
February	60	74	None.	E.N.E.
March	64	76	1.3	Variable.
April	65	78	0.2	Variable.
May	63	72	7.6	N.W.
June	62	68	20.8	W.N.W.
July	62	64	23.7	W.N.W.
August	60	63	24.7	W.N.W.
September	62	67	7	W.N.W.
October	63	68	0.5	W.N.W.
November	60	70	1.5	E.N.E.
December	58	70	0.07	N.E.

An immense quantity of rice is cultivated in the Coorg valleys, and largely exported, but scarcely any dry grain is raised. In 1853 the rice harvest was said to have been worth

seven lacs of rupees. The Coorgs pay so much on the seed sown, as a land-tax, besides a small house-tax, and the cardamom sales yield about 35,000 Rs.[473]

Coffee cultivation was only commenced in Coorg about six years ago, but its extension both amongst natives and Europeans has since been very remarkable. There are now more than a dozen plantations owned by Europeans, chiefly near the road leading down the ghaut from Mercara to the port of Mangalore, and several thousand acres are already under cultivation. Mr. Mann, the largest proprietor, has upwards of 800 acres planted with coffee-trees. The natives too have shown great enterprise in undertaking a cultivation previously unknown to them, and there is now scarcely a hut to be seen without its little coffee-garden. All the plantations on the eastern side of Mercara, excepting one, belong to natives; and close to the town I observed a small clearing where a Coorg was hard at work building himself a hut, cutting away the jungle, leading a small stream into new channels for purposes of irrigation, and planting the slopes of two hills with coffee.

An export duty of four annas the maund is levied on coffee in Coorg, which, in 1861, brought in a revenue of 23,000 Rs. In that year 1,29,869 maunds were exported, 1,17,223 by native growers, and 12,645 by Europeans. This disproportion will not exist this year, as the plants on several new estates will now be in bearing for the first time. The main roads in Coorg are excellent, and one at least of the planters, if not more, has displayed great energy in connecting his estates by good roads with the main Government highways. Most of the available land, within reasonable distance of a highway, is already taken up for coffee cultivation. Labour, as is also the case in Wynaad and the Neilgherries, is chiefly procured from Mysore, the coolies coming up after their own work is done.

It will be seen by the account I have been able to give of the elevation, temperature, and of the periods of drought and moisture in this hill district, that it is not nearly so well adapted for the cultivation of chinchona-plants as Neddiwuttum, and many other localities on the Neilgherry hills. It may be compared, more appropriately, with the forests near Sispara on the Koondahs, as it is exposed to the full force of the south-west monsoon, and suffers from a long drought during the winter.

The country to the north and east of Mercara is a plateau, about 4500 feet above the sea, intersected by ravines full of trees and underwood, amongst which I observed wild orange and lime-trees, *Michelias*, and tree-ferns, with an undergrowth of ferns, *Lobelia*, *Ipomœa*, and *Solanum*. The scenery is charming, with grassy slopes, wooded glades, and here and there a secluded hut in a grove of plantains, on the edge of a small patch of rice cultivation. I also examined some of the forests down the Mangalore ghaut. The road is excellent, winding with a gentle gradient through the beautiful forest scenery past numerous coffee-plantations to their port of shipment at Mangalore. At the fourth milestone from Mercara there is a forest extending for nearly a mile, on the left of the

road, at an elevation of 3800 feet above the sea. It descends from the road to the bottom of the ravine, and on the opposite side there are forest-covered heights of greater elevation. The forest contains many tall trees, not growing very close, with tree-ferns, *Cinnamomum*, *Hymenodictyon*, *Melastomaceæ*, a *Papilionacea* with a bright yellow flower, and ferns, of which I collected five kinds. The general character of the flora appeared suitable for the growth of chinchona-plants; and, though this was the driest time of the year, I found at least one small stream trickling down through the underwood. The valley runs north-west and south-east.

In this locality plants of *C. succirubra* would no doubt flourish, and the experiment ought certainly to be tried; though, from the low elevation, the bark would probably be thin, and would yield perhaps a small per-centage of alkaloids. These points, however, can only be ascertained by experience gained from experimental culture. I was told by Captain Eliott, the Superintendent of Coorg, that the forest in question has been applied for and refused to several coffee-planters. The land belongs to Government, but there is a devil living on it, to which the Coorgs do *poojah*, and the Commissioner of Mysore has, therefore, been hitherto unwilling to allow it to be occupied.

There are many other localities equally suited for the cultivation of *C. succirubra* and *C. micrantha* in Coorg; the Government will shortly establish a chinchona nursery there; and, with so many energetic and intelligent planters in the district, it will be strange if the growth of this important product is not extended and rendered profitable by private enterprise. A few rows of chinchona-plants ought to be established in the loftiest part of each coffee-clearing; and every settler should plant them, and encourage the cultivation among the natives, from motives of humanity, as well as with a view to successful commercial speculation.

We finally left Mercara before dawn, and rode for three miles down the steep ghaut leading to the lower and more extensive valleys of south-eastern Coorg, which we reached as the sun rose. It was a very pleasant ride through the beautiful hill country, with uplands covered with fine forest, and long strips of fertile valley. In the jungles we saw immense clumps of bamboo, which overshadowed the road; a leafless and thorny *Erythrina* with crimson flowers; and a *Solanum* with a small white flower by the road-side. Here and there we came to open grassy glades, whence little footpaths led through the neighbouring jungle to some secluded hut. The cultivated valleys are covered with rice, and fringed with plantain groves and *Caryota urens*.

The *Caryota urens* is a lofty palm-tree, with large leaves, and the Coorgs draw an immense quantity of toddy from it during the hot season. The pith of the trunk of old trees is a kind of sago, and is made into bread and gruel by the natives of many parts of India. Humboldt says that the form of the leaves is very singular, the singularity consisting in their being bipinnatisect, with the ultimate division having the shape of the fin and tail of a fish.[474]

We passed several hundred pack-bullocks conveying Bombay salt from the Malabar ports to the interior, and, having forded the Cauvery at a point where the bed is full of large boulders of rock, reached the village of Virarajendrapett. It consists of two clean streets, at right angles, with a missionary church and school. The mountains are here dotted with plantain-groves, and nearly every house has a small coffee-garden attached. The surrounding country is exceedingly pretty, the view being bounded by forest-covered mountains. The bungalow at Virarajendrapett is on the site of an old palace of the Rajahs, and the compound is surrounded by a high wall, with an ornamental gateway, flanked by stone sentry-boxes.

From this point the descent into Malabar commences, through dense forest, with bright moonlight glancing through the branches of gigantic trees, and after a journey of fifteen miles we reached the bungalow of Ooticully in the middle of the jungle. It is in these forests, on the western slopes of the Coorg mountains, that cardamom cultivation is carried on to a great extent. In February parties of Coorgs start for these western mountains, and, selecting a slope facing west or north, mark one of the largest trees on the steepest declivity. A space about 300 feet long and 40 feet broad is then cleared of brushwood, at the foot of the tree; a platform is rigged about twelve feet up the tree, on which a pair of woodmen stand and hew away right and left until it falls head foremost down the side of the mountain, carrying with it a number of smaller trees in a great crash.

Within three months after the felling, the cardamom-plants in the soil begin to show their heads all over the cleared ground during the first rains of the monsoon, and before the end of the rainy season they grow two or three feet. The ground is then carefully cleared of weeds, and left to itself for a year. In October, twenty months after the felling of the great tree, the cardamom-plants are the height of a man, and the ground is again carefully and thoroughly cleared. In the following April the low fruit-bearing branches shoot forth, and are soon covered with clusters of flowers, and afterwards with capsules. Five months afterwards, in October, the first crop is gathered, and a full harvest is collected in the following year. The harvests continue for six or seven years, when they begin to fail, and another large tree must be cut down in some other locality, so as to let the light in upon a new crop.

The harvest takes place in October, when the grass is very high and sharp, sorely cutting the hands, feet, and faces of the people. It is also covered with innumerable large greedy leeches. The cultivators pick the cardamom capsules from the branches, and convey them to a temporary hut, where the women fill the bags with cardamoms, and carry them home, sometimes to distances of ten or twelve miles. Some families will gather 20 to 30 maunds annually, worth from 600 to 1000 Rs.[475]

This method of cardamom cultivation must be considered injurious to the conservancy of fine timber in the forests, but, on the other hand, the crops themselves are very

valuable, and bring in a considerable revenue. But there is another kind of cultivation carried on in these vast forests on the western slopes of the ghauts, which is far more prejudicial to the production of valuable timber-trees. This is called *kumari*, and *punam* in Malabar. It has been altogether prohibited in Coorg and Mysore, while in Canara it is not now allowed within nine miles of the sea, or three of any navigable river, or in any of the Government forests without previous permission. But in Malabar, where all the forests are private property, the Government is unable to interfere in the matter, and *kumari* is quite unrestricted.

Kumari is cultivation carried on in forest-clearings. A space is cleared on a hill-slope at the end of the year; the wood is left to dry until March or April, and then burnt. The seed, generally *raggee* (*Eleusine coracana*), is sown in the ashes on the fall of the first rain, the ground not being touched with any implement, but merely weeded and fenced. The produce is reaped at the end of the year, and is said to be worth double that which could be procured under ordinary modes of cultivation. A small crop is taken in the second, and perhaps in the third year, and the spot is then deserted and allowed to grow up with jungle. The same spot is cultivated again after 10 or 12 years in Malabar, but in North Canara the wild hill tribes generally clear patches in the virgin forest. Dr. Cleghorn reports that *kumari* renders the land unfit for coffee-cultivation, destroys valuable timber, and makes the locality unhealthy, dense underwood being substituted in the abandoned clearings for tall trees under which the air circulated freely.[476] The Kurumbers and Irulas, wild tribes of the Neilgherries, also raise small crops by burning patches of jungle and scattering seeds over the ashes. This system, which sounds so wasteful and is so injurious to the yield of timber in the forests, is exceedingly profitable to the cultivator, who has no expenses beyond the payment of land-tax, which in these wild unfrequented spots is often evaded. A common profit is 18 to 28 Rs. an acre.

After leaving Ooticully we still had to pass through fifteen miles of jungle, before reaching the open cultivated country in northern Malabar. In driving down the ghaut the views, through occasional openings, of the wide expanses of forest were very grand. Tall trunks of trees towered up to a great height in search of light and air, palms and bamboos waved gracefully over the road, and the range of Coorg mountains filled up the background. Most of the valuable timber has been long since felled in these forests, excepting in the very inaccessible parts. The poon-trees (*Calophyllum angustifolium*), [477] which are chiefly found in Coorg, and yield most valuable spars for masts, have become exceedingly scarce. The young trees are now vigilantly preserved. Black-wood (*Dalbergia latifolia*) is also getting scarce, though I saw a good deal of it in some of the Coorg jungles; and teak-trees of any size have almost entirely disappeared, excepting in the forests of North Canara.

At a distance of twenty miles from the sea the cultivated country commences in this part of Malabar, and the road on each side is lined with pepper-fields, with occasional groves of plantains and clumps of cocoa and betel-nut palms. The land undulates in a succession of hills and dales, with rice cultivation in some of the hollows. Here the pepper is regularly grown in large fields, and not in gardens as at Calicut. In the first place trees are planted in rows, usually such as have rough or prickly bark—the jack, the mango, or the cashew-nut. In the country we were passing through the tree used was an *Erythrina*, with the bark of trunk and branches thickly covered with thorns. Until the trees have grown to the proper size the land is often used for raising plantains. When the trees have attained a height of 15 or 20 feet, the pepper is planted at their bases, and soon thickly covers the stem and festoons over the branches. The pepper-cuttings or suckers are put down by the commencement of the rains in June, and in five years the vine begins to bear. Each vine bears 500 to 700 bunches, which yield about 8 or 10 seers when dried. During its growth it is necessary to remove all suckers, and the vine is pruned, thinned, and kept clear of weeds. The vine bears for thirty years, but every ten years the old stem is cut down and layers are trained. It is an exceedingly pretty cultivation, and, if it was not for the crests of straggling branches which crown the vine-covered trunks, it would not be unlike the hop-fields of Kent.

The houses on the road were built of laterite, large and comfortable like those at Calicut. We saw the people sitting before their doors, busy with their heaps of pepper. When the berries have been gathered they are dried in the sun on mats, and turn from red to black. The white pepper is from the same plant, the fruit being freed from the outer skin by macerating the ripe berries in water. Before reaching Cannanore we passed over three or four miles of elevated rocky land, without cultivation, and arrived in the cantonment late at night.

In enumerating the localities where it is likely that chinchona-plants will thrive, the mountainous country in Mysore, north of Coorg, including Nuggur and the Baba-Bodeen hills, must not be forgotten. Nuggur consists of rounded hills, from 4000 to 5000 feet above the sea, with peaks rising as high as 6000; and the adjoining Baba-Bodeen hills attain a height of 5700 feet. The climate is exceedingly moist, and at the town of Nuggur, on the western side of the hills, the rains last for nine months, during six of which they are so heavy that the inhabitants cannot leave their houses. The eastern side is drier and more level. North of Nuggur the chain of western ghauts sinks down far below the chinchona zone, and north of 14° they scarcely rise above the plain of Dharwar.[478]

There are several profitable coffee plantations in Nuggur, and I understand that it is in contemplation to establish a teak plantation in that district. Though, as a locality for chinchona cultivation, it is not to be compared with the Neilgherries or Pulneys, or even with Coorg, still it is probable that some of the hardier species might thrive there, and

thus the area of the chinchona-plants would be eventually extended from Nuggur, in 14° N., to the hills near Courtallum, in the extreme end of the peninsula.

We embarked at Cannanore on board a little steamer for Bombay. The view from the sea is pretty. On the left is an old fort built long ago by the Dutch; in the centre, looking from the anchorage, is a sandy beach, where elephants were being loaded with the luggage of a detachment of troops just arrived from Calicut; and a little to the right is the native town surrounded by extensive groves of cocoanut-trees, with the blue line of the Coorg and Wynaad mountains visible in the distance. There are three very large buildings on the sea-shore, one of which is the palace of the Beebee, a long house, with the ground-floor let out as a pepper warehouse.

The Portuguese built a fort at Cannanore in 1505. They were driven out by the Dutch, who sold the place to a Moplah, from whom the present Beebee of Cannanore is descended, the succession going in the female line. She is much in debt, but owns the Laccadive islands, as well as Cannanore, and the land round the town. We were told that the Beebee considered that she had been shamefully treated by the English Government, and that she spoke her mind very freely on the subject. It appears that, in about 1545, the Laccadive islands were conferred in jagheer on the head of the Moplah caste at Cannanore, the ancestor of the Beebee, by the Rajah of Cherikul, on the payment of a certain tribute, which was duly rendered to the Cherikul family until its destruction by Hyder Ali in the last century. After the storming of Cannanore by the English in 1791, the islands came into possession of the East India Company, and in 1799 they were restored to the Beebee's family, subject to the payment of an annual *peshcush* of 10,000 Rs.

In April, 1847, a hurricane of unequalled violence swept over the islands, which are only nine feet above the sea in the highest part. The wind tore up the trees by the roots, the waves flooded the land, and almost everything on the two most valuable islands was destroyed. The Beebee borrowed a steamer from the Government to send supplies for the relief of the islanders, and she also obtained a remission of one-third of the *peshcush* for ten years, on certain conditions connected with reforms in her administration. Her difficulties have chiefly arisen from being unable to pay the sum demanded for arrears of *peshcush*, and for the use of the steamer, and in 1854 the English Government assumed the administration of the islands until the debt was paid. It was desired that the Beebee should give them up altogether for a pecuniary equivalent, but to this she has resolutely refused to consent. The islands have since been restored to her.[479]

On the day after sailing from Cannanore we put into Mangalore, where the town, like that of Calicut, is completely hidden from the sea, the lighthouse and a few bungalows being visible on a hill in the rear. This was the dry season, and the coast of Canara was not nearly so pretty as that of Malabar, looking parched and dried up. North of

Mangalore is the port of Compta, with a lighthouse on a steep conical hill, but no town visible. Compta is now the port of shipment for the cotton of Dharwar, and there were several *pattamars* in the anchorage, with their decks piled up with bales of cotton. They take it up to Bombay, where it is pressed and shipped for England; and we heard that the crews of the pattamars work their way into the bales, and pull out large handfuls of cotton, filling the space up with filth. In this way there is a petty trade in stolen cotton along the coast, and the people work it up into gloves, stockings, &c., for sale.

Though, at the time of my visit, Compta was used as the cotton-port for Dharwar, yet the port of Sedashighur, further north, has a great advantage over it, and is the only place along the coast where there is safe anchorage during the S.W. monsoon. A point of land, called Carwar head, forms and protects the bay of Carwar and Beitcool cove, and, with the assistance of a breakwater, there would be safe anchorage throughout the year. A line of islands and rocks, called the Oyster rocks, a little to the northward, also offers a place of shelter. There is an anchorage under their lee during the S.W. monsoon, where vessels might ride in perfect safety, and, when a lighthouse is established on the highest Oyster rock, vessels will be able to approach this dangerous coast, and run into the anchorage, during the summer months. Sedashighur is nearer Dharwar than any other port; a river, the Kala-nuddee, navigable for boats for twenty miles, falls into the sea close to the anchorage, and a good road is all that is required to make this place an important port for the shipment of cotton. Energetic measures have already been adopted for this purpose, and it will not be long before Dharwar, the only cotton district in India where the American species has as yet been profitably cultivated, will be supplied with a port where the cotton may be pressed and shipped direct for England. [480]

After passing Sedashighur we put into Goa harbour, and went thence to Vingorla, the port of the Belgaum district, and a great place for the manufacture of earthenware chatties, which are taken up the coast in pattamars. The following day we were at Rutnagherry, and passing Sevendroog, the famous stronghold of the pirate Angria, we concluded our coasting voyage by anchoring in Bombay harbour.

CHAPTER XXVII.

THE MAHABALESHWUR HILLS AND THE DECCAN.

Journey from Bombay to Malcolm-penth—The Mahabaleshwur Hills—The village and its temples—Elevation of the hills—Formation—Soil—Climate—Vegetation—Sites for chinchona-plantations—Paunchgunny—Waee—Its temples—The babool-tree—Shirwul—The village system—Village officials—Barra balloota—Cultivators—Festivals—Crops and harvests—Poona—The Bhore ghaut—Return to Bombay.

THE districts best adapted for the cultivation of chinchona-plants are those in the southern part of the peninsula, at suitable elevations, which receive moisture from both monsoons. The Neilgherry hills are the centre of these hill districts, and as we advance further from that nucleus in a northerly direction the rainfall from the south-west monsoon becomes heavier, while the climate of the winter, when easterly winds are blowing, increases in dryness. In 14° N. lat. the hills of Nuggur sink down into the plains of Dharwar, and from that point to the Mahabaleshwur hills in 18° N. there are few parts of the western ghauts which attain a sufficient elevation for the successful growth of chinchona-plants.[481]

The Mahabaleshwurs, however, are upwards of 4000 feet above the sea, and it was therefore possible that they might present localities suitable for chinchona cultivation. In February 1861 I started from the Mazagon bunder, at Bombay, in a bunder-boat, for the purpose of examining these hills, and, crossing the harbour, coasted for a short distance along the shores of the Concan, and then sailed up the Nagotna river, with low jungle on either side. At Nagotna two sets of *hamals* were waiting for us, and we started for Mhar, a distance of forty miles across the low country of the Concan. The *hamals* or palkee-bearers belong to the *Mhar* or *Parwari* caste, who are also watchmen, porters, and guides, and are believed to be the aborigines of the country. They are athletic men, with slender and remarkably symmetrical figures when young, always working in gangs of twelve to each palkee, three at each end, and the others relieving them at intervals. They carry the weight with a skill which only a life-long practice could give, and go over the ground at the rate of four miles an hour, at a sort of trot.

The country is generally well covered with rice-fields, now in stubble; and the numerous stacks of rice-straw, raised five or six feet from the ground on stakes, formed the principal feature of the landscape. A few miles beyond Mhar the western ghauts rise abruptly from the plain of the Concan, in two gigantic steps. The first step is ascended by the steep corkscrew road of the Parr ghaut, and between its summit and the foot of the Rartunda ghaut, which winds up the second step, there is a level cultivated plateau. To the left of the road, overlooking the Concan, there is a steep conical hill, crowned by

the famous robber fort of Pertaubghur. Here, in 1659, Sevajee, the famous founder of Mahratta power, assassinated Afzul Khan, the general of the Mohammedan King of Beejapore's army, at an interview. We could see the dark walls of the fort, with ruined buildings, and a tall tree rising behind them. The ascent of the second ghaut brought us, almost immediately, into the hill station of Mahabaleshwur. The view from our lodging embraced a foreground of rounded hills covered with green wood, with ranges of pointed, rounded, and flattened peaks in the distance, shimmering in the rays of a hot sun.

The Mahabaleshwur hills are the loftiest part of the western ghauts in the Bombay presidency. They form an undulating table-land of small extent, terminated to the westward by a very abrupt descent, often forming scarped precipices overhanging the Concan; and sloping down more gradually on the side of the Deccan. The highest point, close to the English station, in lat. 17° 59′ N., is only 4700 feet above the sea. The English station, with a native bazar and village, was formed by Sir John Malcolm in 1828, and has received the name of Malcolm-penth. Several of the surrounding peaks are named after his daughters. The roads are excellent, and are bordered by such trees and shrubs as jasmine, figs, *Randias*, *Gnidias*, and *Crotalariæ*, with a pretty white *Clematis* climbing over them. The station is near the edge of a range of precipitous mountain crags and cliffs overlooking the Parr valley. The cliffs are broken by several profound ravines, thus forming promontories commanding grand views of the hill fort of Pertaubghur, the Concan, and even the sea on very clear days. Good carriage-roads have been made to those points which command the best views, such as Babington, Bombay, Sidney, and Elphinstone points, all looking west. From Babington point there is a magnificent view. The station, with numerous bungalows peeping out amongst the trees to the north, is seen along the crest of a ridge which is separated from Babington point by a profound ravine. The precipitous cliffs, now dried up and barren, are scarped and furrowed by the water which deluges them during the prevalence of the south-west monsoon; but there was one bright green spot where some potatoes were cultivated in terraces, on the edge of a precipice.

The most conspicuous object in the station is an obelisk of laterite, erected to the memory of Sir Sidney Beckwith. From this point, immediately above the little thatched church, there is a good view of the station, the numerous bungalows, peeping out amongst their shrubberies, dotted about in all directions; the billiard bungalow, sanatarium, and public library, all built of laterite, standing in an open space; the native bazar at our feet; and a curiously shaped mass of mountain peaks to the south and west.

One day we rode over to the native village of Mahabaleshwur, which is three miles from Malcolm-penth. The little village consists of a few dozen thatched huts, on the side of a wooded hill, and some very interesting temples. By the roadside, in the hedges

surrounding the huts, there were roses, daturas, and jambul-trees (*Eugenia jambolanum*) with heads of graceful flowers.

The chief temple, built at the foot of a steep hill, has an open space in front. The exterior wall is faced with pilasters painted yellow, the intermediate space being red. In the centre there is an arched doorway leading into an interior cloister, built round a tank. No European is allowed to enter, but, from the outside, a cow carved in stone is visible on the opposite side of the tank, with a stream of water pouring from its mouth. This fountain is said to be the source of the Krishna, and the temple is considered very sacred in consequence. To the right, and a little in front of the temple, there is a square chapel sacred to Siva or Mahadeo. A flight of steps leads up to three narrow arched doorways, the centre one being occupied by an image of the bull *Nandi* in stone, in a sitting posture, with its back to the people, and facing the image of the God inside. The chapel is surmounted by a very picturesque dome, with stone tigers at each angle. Tall trees and thick bushes cover the hill in the rear immediately above the larger temple, and on the left there is a long native *choultry*, with a thatched roof.

These temples were built about a century ago by a rich banker of Sattara, but they stand on the sites of more ancient structures, the work of Gowlee Rajahs. The Gowlees are a race of aboriginal herdsmen, scattered over the western ghauts from Mahabaleshwur to Kolapore. Though they now speak the Mahratta language, yet a great number of their words, their features, and many of their customs are Canarese; and they are evidently a branch of the great Dravidian group of nations.

The temples of Mahabaleshwur possess extensive landed property, some of it on the slopes overhanging the Parr valley. It is in charge of an hereditary Enamdar, who lives in the Deccan, and visits the temples once a year. He keeps them in tolerable repair, and pockets the surplus of their revenues. From the village there is an extensive view of the deep valley of the Krishna and Yena, to the eastward, which slopes down abruptly from the hill on which Mahabaleshwur is built.

As in Coorg there is a curious legend respecting the origin of the Cauvery, so in the Mahabaleshwur hills an equally wild story is attached to the source of the Krishna. It is said that two giants, called Mahaballee and Anteeballee, made war upon the Brahmins, until they were destroyed by Siva. Before they died they asked a favour, which was granted, namely, that they and their followers might be turned into rivers. This is the fabulous origin of five rivers:—the Krishna, named in honour of one of Vishnu's avaturs; the Koina and the Yena, flowing to the Deccan; and the rivers Sawitri and Gawitri, finding their way through gorges to the westward, and becoming tributaries of the Bancoot river in the Concan. The Krishna is looked upon as a personation of the God Krishna in a female form, and is often called *baee* or lady Krishna. This important stream, issuing from the cow's mouth at Mahabaleshwur, flows down a gorge bounded by steep barren hills, terminating in rocky cliffs. We could see the river, like a silver

thread, meandering through some cultivated land far below; but the general aspect of the country was barren and cheerless. During the monsoon it is doubtless quite green.

The Mahabaleshwur hills average an elevation of 4500 feet above the sea. They are composed almost entirely of laterite,[482] overlying eruptive rocks, such as basalt, greenstone, and amygdaloid; and the soil is a clay resulting from the disintegration of the laterite.

On these hills October is the commencement of the dry season, but during that month the amount of aqueous vapour in the atmosphere is still considerable, while the temperature is cool and equable. From November the air becomes gradually drier until the end of February; the weather is dry and cold, and a sharp dry easterly wind usually prevails. The mean temperature of this season is 64°, with a daily variation of about 12°. Fogs and mists commence in March, and gradually increase until the rain begins in the end of May. The hottest month is April. From the end of May to September there is almost incessant rain, and the hills are constantly enveloped in clouds and fog. The mean temperature of the rainy season is 64.5°, but the daily variation is only 3°. The average rainfall is 227 inches, of which nearly one-third comes down in August.[483] (See Table, next page.)

The vegetation of these hills, as might be expected from the essential difference in the climate, is quite distinct from that of the Neilgherries. There is a great want of forest-trees in the jungles, and the trees and bushes are, as a rule, poor and stunted. The hills are covered with grass and ferns, and are dotted over with a shrub called by the natives *rumeta*. It is the *Lasiosiphon speciosus*,[484] with flowers something like small Guelder roses, clustered in terminal umbels. The *Randia dumetorum*, a thorny bush, is also common. In the thickets I observed a *Memecylon*, called by the natives *anjun*, a melastomaceous tree, with beautiful purple flowers;[485] a small *Crotalaria*, with a bright yellow flower; a *Jasminum*; an *Indigofera*; the *Eugenia Jambolanum*; the pretty creeping *Clematis Wightiana*; some willows near streams; a *Solanum*; and the *Curcuma caulina*, a kind of arrowroot, with enormous leaves, sometimes tinged with red,[486] in flower during the rains.[487]

MAHABALESHWUR HILLS.								
MONTH.	Mean Temperature.	Mean Maximum.	Mean Minimum.	Extreme Maximum.	Extreme Minimum.	Mean daily Variation.	Rainfall in inches.	WIND.
Jan.	63	70	56	75	45	14	None.	N.E.
Feb.	64	72	57	78	46	14	0.3	N.N.W.
March	71	79	65	87	57	13	0.07	Do.
April	74	81	67	90	56	13	1.3	N.W.
May	71	78	66	88	57	12	1.45	Westerly.
June	67	70	63	82	62	6	47.9	W.S.W.
July	63	64	62	73	62	1	67.4	Do.
Aug.	63	65	63	70	61	2	81.8	Do.
Sept.	64	66	62	73	56	3	30.6	Do.
Oct.	65	70	61	73	54	8	5.5	Easterly.
Nov.	64	70	58	72	51	11	2.9	Do.
Dec.	63	68	58	73	49	10	0.2	Do.

I reluctantly came to the conclusion that the Mahabaleshwur hills were not well suited for the growth of chinchona-plants. The intense dryness of the atmosphere during the greater part of the year, the poor character of the vegetation, and even the enormous rainfall during the summer months, which more resembles the climatic conditions of the forests of Canelos to the eastward, than the region of "red-bark" trees to the westward of Chimborazo, all pointed to this conclusion. Nevertheless some seeds of chinchona-plants were forwarded to Mr. Dalzell, the Conservator of forests in the Bombay Presidency, which are said to have come up well at Mahabaleshwur. If these plants should really thrive it will prove that they are capable of adapting themselves to differences of climate to an extent of which we previously had no idea. I sincerely trust that this may be the case, and that some at least of the species of Chinchonæ now in India may be successfully introduced into the Mahabaleshwur hills. Mr. Dalzell informs me that there are high hills to the eastward of the Portuguese settlement of Goa, but not so elevated as Mahabaleshwur, where he thinks that some of the Chinchonæ, which flourish at low elevations, might be acclimatized. He had observed that, in the Bombay Presidency, a difference of 150 to 200 miles southing is equivalent to a certain elevation, that is, that plants confined to the highest ground in lat. 18° are found at a much lower level in lat. 15°; and that members of the family of Chinchonaceæ increase in the number of genera and species as we travel south from Mahabaleshwur, along the summit of the range, to lat. 15°.

The road down into the Deccan, from Malcolm-penth, leads to the eastward over hills bare of jungle, and sprinkled over with a scanty growth of *Lasiosiphons* and ferns. After six miles it begins to pass along a ridge or saddle, with the deep valley of the Krishna on one side, and that of the Yena on the other. The hills which bound these valleys are very precipitous, and, at this season, look grey and barren, with ridges of rock cropping out, entirely destitute of all vegetation. The valleys and lower slopes of

the hills are covered with fields of grain, now in stubble, but which must look bright and green during the rainy season.

At a distance of ten miles from Malcolm-penth, on a slope overlooking the Krishna valley, there are some small experimental farms, belonging to apothecaries in Sir Jamsetjee Jeejeebhoy's hospital at Bombay, at a place called Paunchgunny. An application was made for some chinchona-plants, to be raised at Paunchgunny; no doubt all possible care and attention would have been bestowed upon them; and I, therefore, regret that it should be a locality where they are not at all likely to flourish. Here the road descends the Tai ghaut into the Deccan, and in a couple of hours we reached the bungalow on the banks of the river Krishna, opposite the town of Waee.

The town on the other side of the river, with its numerous temples, was by far the most interesting place, in an architectural point of view, that we had yet seen. Long flights of stone steps lead up from the waters of the sacred Krishna to the paved platform on which the temples are built. Crowds of women and children in blue dresses, and men in white cotton cloths and red turbans, were washing their clothes in the river, or sitting on the steps and gazing into the water, while naked Brahmins employed themselves in scrubbing the copper utensils of the temples. The largest and most imposing temple is that dedicated to Ganesa, or Gunputty as he is called in the Deccan. It is a mass of solid masonry, whence a wide flight of stone steps leads down to the Krishna. The shrine itself is a plain stone building, with a large vestibule in front, consisting of four arched entrances on each side, and three at the end. The ceiling of this porch is very curious. It is formed of square flagstones fitted into each other, and clamped together above, so as to make a flat surface exactly resembling the pavement below. From the porch a square doorway leads into the shrine, which is a small chamber without ornament or decoration, with the colossal figure of Gunputty facing the entrance. The idol, with a huge elephant's head, the trunk of which it holds in one of its four hands, an enormous belly, and cross legs, is hewn out of a solid block of black stone.

The temple of Gunputty is surmounted by a very remarkable spire, consisting of broad concave flutings rising out of a circlet of lotus-leaves, and approaching each other slightly as they ascend, until they finally terminate in another circle of lotus-leaves, out of which a fluted dome rises and crowns the spire. The whole effect is very good, and forms the principal feature in the view of Waee from the right bank of the Krishna.

A little further back there is a small temple dedicated to Siva or Mahadeo, surrounded by a high wall. Within the enclosure, and in front of the shrine, there is a canopy supported on sixteen stone columns, the inner four being under a small dome, and the rest of the roof consisting of a very curious pavement-like ceiling, exactly similar to that in front of Gunputty's temple. Advancing through this vestibule, which is a plain but perfect piece of masonry in very good taste, we came to a large image of Siva's bull, called *Nandi*, under a *mandap* or canopy, supported by four pillars. The image, which

is in a sitting posture, with its head turned towards the door of the shrine, has numerous ornaments carved about its head and neck, amongst them a necklace of bells. It is hewn out of an immense block of stone. Immediately in front of *Nandi* is the shrine itself, but the interior was too dark to enable us to discern the god. The lower part of the building is of plain masonry, with two small square windows in fretted stone-work; but the upper part is surmounted by a richly-carved spire and dome, while on the cornice of the roof there are niches containing stone figures. The spire has three tiers of gods round it in niches, and is crowned by a fluted dome, resting on a circlet of lotus-leaves. There is another temple on the platform facing the river, dedicated to Parvati, Siva's wife.

By the time we had completed the examination of these temples, we were surrounded by a great crowd of Brahmins, *hamals*, girls and boys, who continued to follow us about.

We then went up one of the streets of this most devout little town, and came to a temple dedicated to Vishnu, the enclosure of which is also surrounded by a high wall, with lean-to grain-shops outside. The interior of the enclosure is lined with betel-nut palms, and paved with large flags, on one of which the figure of a tortoise is carved. The temple stands in the centre, with a richly ornamented spire above it. The interior consists of a nave, with aisles on each side, and at the end, opposite the doorway, there is an open grating, within which is the deity. The temple was crowded with nautch-girls, and numbers of people were passing in and out, doing *poojah*. They first prostrated themselves at the entrance, then before the grating, and finally touched a bell overhead before giving place to other devotees. Nearly opposite Vishnu's temple is another to his wife Lakshmi.

We afterwards walked through the bazar, a busy interesting scene, crowded with people. We saw exposed for sale grains of all kinds in baskets, heaps of red ochre for painting Gods and the sect-marks on the forehead,[488] sweetmeats, cotton cloths, muslins, and chatties of clay and copper. Near the river there are five smaller temples to Siva, each with its *Nandi* outside the door, and many sacred peepul-trees, surrounded by walls of solid masonry.

At sunset the view of Waee from the opposite side of the river, with the temples reflected in the water, the thickets of trees behind, and the crowds of people in snow-white cotton dresses and red turbans, was enchanting. Waee derives its great sanctity partly from being on the banks of the sacred Krishna, and partly from the tradition that it was the residence of the five Pandus, the favourite mythical heroes of the Hindus, during part of the time of their exile. The people still have many tales respecting their deeds, especially those of Bhima, who was the biggest and strongest of the five. A peak rising above the dried-up barren line of mountains behind the town is called after them *Pandughur*. The temples of Waee were chiefly built, about a century ago, by the head of a wealthy Mahratta family named Rastia.

From Waee we travelled over dried-up plains, with arid desolate hills in the distance, and reached the village of Shirwul at early dawn. There were a few banyans near the road, and some babool-trees (*Acacia Arabica*) dotted about over the plain. The babool-tree in the Deccan has the same uses as the carob in Peru. The hard tough wood is extensively used for ploughshares, naves of wheels, and tent-pegs; its necklace-shaped pods are favourite food for sheep and goats, and the bark is used for tanning.[489] It flourishes on dry arid plains, and especially in black cotton-soil, where other trees are rarely met with. The hedges round Shirwul are of prickly pear or milk-bush (*Euphorbia tirucalli*[490]).

Shirwul is one amongst many of those village communities of the Deccan which have retained their peculiar customs and organization from time immemorial. The Hindu Rajahs have been succeeded by Mohammedan Kings, who in their turn have been followed by Mogul Subadars, Mahratta Peishwas, and English Collectors, but the village communities have continued unchanged through all these revolutions, and thus the great mass of the people still live under institutions which excite veneration from their immense age. The cultivator of the Deccan obeys precisely the same rules and has the same customs as were followed by his ancestor before the period of history commenced; and, as the land-assessment has now been established for thirty years, on remarkably easy terms, his condition may not disadvantageously be compared with that of any other peasantry in the world.

The village-system of the Deccan is so curious in itself, and so interesting from its unknown antiquity, that some account of one of the villages a few miles from Poona, similar in all respects to that of Shirwul, will not be out of place. I have taken it from an article written thirty years ago.[491]

The land belonging to the village comprises 3669 acres, 1955 arable and the rest common pasture, with hedges of milk-bush (*Euphorbia tirucalli*) enclosing the garden-grounds. The village, which is surrounded by a mud wall with two gates, includes 107 dwelling-houses of sun-dried bricks with terraced roofs, a *chowree* or town-hall, and three temples. The houses have *wosurees* or open porticos in front, and the interiors consist of three or four small dark rooms with no windows. The temples are of hewn stone and *chunam*.

The boundaries and institutions of the village have undergone no alteration from time immemorial, and its offices are hereditary. They consist of that of the *Pattel* or chief magistrate, his deputy the *Chowgulla*, the *Koolcurny* or accountant, and of the *Barra Balloota*, or twelve subordinate servants.

The *Pattel* holds his office, which is hereditary and saleable, from Government, under a written obligation specifying his duties, rank, and the ceremonies he is entitled to. He has to collect the Government dues from the cultivators, punish offences, redress

wrongs, and settle disputes. In important cases he summons a *Punchayet* or sort of jury, and when they are of a serious nature he refers them to the *Amildar* or Collector of revenue.

The *Koolcurny* or accountant keeps the records and accounts, comprising a general measurement of village-lands, a list of fields, of the inhabitants, and a detailed account of the revenue. He is generally a Brahmin, and has lands or fees allotted to him by Government.

The *Barra Balloota* offices are hereditary, and the holders, called *Ballootadars*, are bound to their services to the community for a fixed proportion of the produce of the soil, from each cultivator. They are twelve in number, namely, the *Sutar* or carpenter, who repairs all wooden instruments; the *Lohar* or blacksmith, who keeps all iron-work in repair; the *Parit* or washerman, who washes all the men's clothes; the *Nahawi* or barber, who shaves and cuts the nails of the villagers, and kneads the muscles and cracks the joints of the Pattel and Koolcurny; the *Kumbhar* or potter; the *Potedar* or silversmith; the *Goorow* or dresser of idols; the *Koli* or water-carrier; the *Mang* or ropemaker, who makes ropes of *Hibiscus cannabis*, and is of very low caste; and the *Mhar* or *Parwarree*, an outcast whose dwelling is outside the village—he acts as watchman, carries letters, and gives evidence as to village rights, before Punchayets; the *Tsamhar* or cobbler, and *Gramjosi* or astrologer.

Besides the above duties, the Ballootadars have certain perquisites. The carpenter furnishes the stool on which the brides and bridegrooms are bathed in the marriage ceremony; the blacksmith sticks the hook through the flesh of devotees who swing; the barber plays on the pipe and tabor at weddings; and the potter prepares the stewed mutton at harvest-homes. In addition to the Ballootadars there are some other lower officials called *Alutadars*, consisting of a watchman, gatekeeper, betel-man, gardener, bard, musician, and host of the Ganjams of the Lingayet sect.

The cultivators of the Deccan are lean short men, with black straight hair, kept shorn except on the upper lip, bronze complexions, high cheek-bones, low foreheads, and teeth stained with betel. They are temperate and hard-working, warmly attached to their children, frugal, and not improvident, but deceitful, cunning, and false. Their food consists of grains, pulses, greens, roots, fruits, hot spices, and oil; together with milk and ghee. No liquor is sold in the villages. Their every-day fare is first a cake of *bajree*,[492] or *jowaree*,[493] baked on a plate of iron; secondly green pods or fruits cut in pieces, and boiled with pepper, garlic, or turmeric; and thirdly a porridge of coarse-ground *jowaree* and salt. They have three meals daily. For breakfast they eat a cake with spiced vegetables, and a raw onion; their wives bring them their dinners in the fields at noon, consisting of two cakes and green pods boiled; and porridge and milk form their suppers. The holiday fare is cakes of pulse and sugar, and balls of split gram and spices.[494]

These hard-working people generally wear nothing but a dirty rag between their legs, and another round their heads. On holidays, however, they come out in a white turban, a frock of white cloth coming down to the knees, a cloth round the waist, and a pair of drawers. The furniture of their dwellings generally comprises two wooden pestles and a stone mortar, earthenware and copper utensils, a wooden dish for kneading dough, a flat stone and rolling pin for powdering spices, two iron cups for lamps suspended by a chain, and two couches laced with rope; the total value being about 40 shillings.

The men, as well as the women, are very fond of attending annual pilgrimages at the temples, and several festivals break the monotony of their working days, the chief of which are the *Hooli*, the *Dussera*, the *Dewallee*, and another in honour of the cattle. The *Hooli* is held at the full moon in April, and lasts five days. The *Dussera*, to celebrate the destruction of the Demon Mysore by the Goddess Kali, is in October, and the *Dewallee* twenty days afterwards. The cattle festival is in August, when the oxen are painted and dressed up, fed with sugar, and worshipped by their owners. In the hot dry months the cultivators hunt deer, hares, and wild hogs.

The agricultural implements used in the Deccan are the same as were in use upwards of 3000 years ago. They consist of a plough, which makes a mere scratch, made of babool-wood; a rude cart on two solid wheels; a harrow with wooden teeth; and a drill-plough. [495] The oxen do most of the work; and the sheep are black and white, with long hanging ears. There are two crops, called the *Khereef* and *Rubbee*. In the *Khereef* crop the sowing takes place in June and July, and the harvest in October. *Bajree* is sown with a drill-plough in rows, mixed with *toor* and other pulses. It is the chief food of the people. Next comes the other common grain *jowaree*. Italian millet, *raggee*, *badlee*, and the *amaranthus* are sown in smaller quantities. All land, whether ploughed or not, is subjected to the drag-hoe, first lengthways and then across, loosening the surface and destroying weeds: and crops of millets are alternated with those of pulses. When the harvest begins, a level spot is chosen for a threshing-floor, and made dry and hard. A pole, five feet high, is fixed in the centre, the grains are heaped round the floor, and the women break off the ears and throw them in. Oxen are then tied to each other and to the post, and driven round, to beat out the corn. Winnowing is done by a man standing on a high stool, and pouring out the grain and chaff to the winds. Ceremonies are then performed in honour of the five Pandus, and the grain is stored in large baskets. The pulses which are sown in the *Khereef* crop are *toor* raised in *jowaree* and *bajree* fields, the pods of which are detached by beating the plant with a log of wood; *moong*, sown by itself, and when ripe pulled up by the roots; *ooreed*; *mutkee*; and *lablab*.

Plants from which cordage is made, namely the *sun* (*Crotalaria juncea*) and *ambadee* (*Hibiscus cannabinus*) are also raised. They grow to a height of five or six feet, and are then pulled up, steeped for some days in water, and the bark stripped off.

In the *Rubbee*, or cold season crop, the sowing takes place in October and November, and the harvests in February. At this time wheat is sown in rich black or loamy soil, well manured; *gram* (*Cicer arietinum*) in the best black soil; and flax, generally raised on the edge of wheat-fields, in strips of four rows. The land is only ploughed once in two years, to the depth of a span.

As the Indians of Peru live chiefly on roots, so the natives of the parts of India which I visited find their chief sustenance in numerous kinds of millets and pulses. Rice is certainly their favourite food; but, from the expenses attending the necessary irrigation, it is dearer and not so easily attainable as the other cereals, and the great mass of the people live on dry grains and pulses. All these cereals contain less nourishing matter than wheat, being comparatively poor in nitrogen, but this deficiency is made up by the pulses which are generally eaten with them. It is a most remarkable fact that the natives habitually combine these two different kinds of food, in their dishes, in about the same proportions as science has found to be necessary in order that the mixture may contain the same proportion of carbonous to nitrogenous matter as is found in wheat.[496]

Every one who has travelled much, in different parts of the world, or who has reflected at all on the subject, well knows that there is far more happiness than misery on this earth, that the good outweighs the evil, and that the wars and revolutions of history are but specks on the long periods of tranquillity which remain for ever unrecorded. The village system of the Deccan is a venerable monument, reminding us how little the turmoils and civil wars, invasions, and revolutions, of which history is composed, affect the mass of the people. The endless conspiracies, treasons, massacres, and battles which fill the narrative of Briggs's Ferishta might not have happened in the Deccan at all, for all the change they have effected in the institutions and customs of the bulk of the population. The Ballootadar still holds the same office which was filled by his ancestor centuries ago, performs the same service, and receives the same perquisites. The cultivator uses the same implements, raises the same crops in the same way, and practises the same customs. As it was centuries ago, so it is now; nothing is changed, and these time-honoured institutions continue to be admirably adapted to the simple wants and habits of the people who live under them. These Deccanees now enjoy their land for a very trifling assessment unalterable for thirty years, their means are sufficient to supply themselves and their families with all they require in the way of clothing and furniture, they have a considerable variety in their food, days of relaxation and festivity are not of rare occurrence, their immediate superiors are of their own race and religion, and there is little to remind them of the presence of foreign rulers. On the whole, in their own simple way, they probably enjoy as much happiness as the peasantry of most other countries in the world, while their wants are fewer and their desires more easily attainable.

In the country between Shirwul and Poona the harvest had already been reaped when we crossed it. In one or two places there were avenues of mango-trees by the road-side, but generally the country was bare and treeless. The great city of Poona, once the seat of Mahratta power, still retains the signs of its former splendour. In the narrow crowded streets there are many large houses of two stories, with much richly carved wood about the balconies and doorways, and frescos painted on the walls of Gods and Goddesses, and scenes in the lives of the Pandus or of Krishna. The bazar is generally thronged with Brahmins, Moslems, Lingayets, Bohrahs, Parsees, men, women, and children, while the shops are occupied by silversmiths, workers in copper, brass, and wood; sellers of grains, drugs, oils, and ingredients for curries; of sweetmeats, of cloths, of blue and green bangles for women, and of endless other wares. The temples are numerous, but none of them are remarkable either for size or beauty. The old palace of the Peishwas forms one side of an open space, and is surrounded by a high wall with semicircular bastions. The entrance is by an archway, flanked on either side by solid Norman-looking towers, with a balcony over it, extending from one tower to the other, from which the young Peishwa Mahadeo Rao threw himself in 1795.

In 1773 the Peishwa Narrain Rao was murdered in this gloomy-looking castle by his uncle Ragonath Rao, and many another deed of darkness has been done within its walls.

Leaving the town, we drove past the *Hira Bagh* or "diamond garden," where there is a large tank with a wooded island in the centre, to the foot of the rocky hill of Parbutty, on the summit of which there is a temple to Siva. The ascent is by a well-cut flight of steps, and the temple,[497] which crowns the hill, is surrounded by a wall of very solid masonry, with a covered gallery having quaintly carved wooden balconies, and an open rampart above. From one of these balconies Bajee Rao, the last of the Peishwas, watched the defeat of his army at Kirkee in 1817; when Poona, and all its territory, became an integral part of British India.

The view from the Parbutty hill is very extensive. At our feet was the *Hira Bagh*, with its broad sheet of water, and numerous groves of trees; beyond was the great city almost hidden by trees, the roofs of houses showing here and there, but no conspicuous towers or lofty building. Further still we could see the windings of the rivers Mula and Muta, tributaries of the Krishna. To the left was the village of Kirkee, and to the right the churches, numerous bungalows, and other buildings of the English cantonment. At this time of year the whole mass of buildings and gardens forming and mingling with the city and cantonment, is surrounded by brown dried-up plains, and rocky arid-looking mountains, which furnish a sombre frame to the picture.

This magnificent view was exceedingly interesting, because it seemed more than probable that, in a not far distant future, the city of Poona might become the capital of British India—the seat of Government of a vast Empire, united for the first time in history under one firm and beneficent rule, enjoying a universal peace unknown for

centuries, and rapidly advancing in material prosperity. Calcutta must be given up as the most distant from England, the least conveniently situated as regards other parts of India, and the most unhealthy place that could be selected for a capital. This point once granted, the old Mahratta capital recommends itself as combining all the advantages in which the pestiferous banks of the Hooghly are deficient. Poona is within a few hours' journey of the port of Bombay by railroad; situated on an elevated table-land, its climate is healthy and suitable both for Europeans and natives; and it is in a central position as regards all the Presidencies of India.

The railroad from Poona to Bombay stopped at Khandalla, on the summit of the Bhore ghaut, where a portion of it is still unfinished. The village of Khandalla is perched on the edge of a deep chasm, mountains rise up into sharp peaks to the right and left, and there is a very extensive view over the Concan plains. Here the passengers had to get out of the train, and go down the ghaut by the excellent road made by Sir John Malcolm, in bullock-*gharries* or in *palkees*, on ponies or on foot. The works of the railway were, however, progressing fast; and when finished, the railroad up the Bhore ghaut will be one of the most remarkable works of the kind in the world. The station at Khandalla is 1800 feet, and Kampuli, at the foot of the ghaut, barely 200 feet above the sea. For a distance of 220 miles there are no passes for wheeled vehicles from Bombay to the interior, except the Bhore and Tal ghauts, so precipitous is the volcanic scarp which forms this portion of the western mountains.

The railroad incline down the Bhore ghaut is upwards of fifteen miles long, the rise being 1831 feet, and the average gradient 1 in 48. In this distance there will be 2535 yards of tunnelling, besides an immense amount of cutting and embanking, eight viaducts, and eighteen bridges. The best known work of this kind in Europe is at Semmering, across the Noric Alps; but that of the Bhore ghaut exceeds it in length, in height, and in the steepness of the gradient.

At the foot of the Bhore ghaut is the village of Kampuli, whence the railroad runs across the plains of the Concan, over an arm of the sea, past Tannah, and through the island of Salsette, into the town of Bombay.

I had now personally examined the Neilgherry hills, the Koondahs, the Pulneys, Coorg, and the Mahabaleshwurs; and collected information respecting the hills near Courtallum, the Anamallays, the Shervaroys, Wynaad, the Baba-Bodeens, and Nuggur. After a careful consideration of the conditions which each of these districts offer, and a comparison of their elevations, climate, soil, and the character of their vegetation, with those of the South American chinchona forests; I was fully confirmed in the opinion that the mountains of the Indian peninsula offered a splendid field for the cultivation of this new and most valuable product.

The different species thrive in different localities, and require various modes of treatment, but I am inclined to the belief that one species or another will thrive in all the

hills from Cape Comorin to the parallel of 14° N. This view may prove to be too sanguine, and it may be that the droughts at one season, and the excessive rainfall in another, in several of the hill districts, will prove prejudicial to successful cultivation. Under any circumstances, however, there can be no doubt that the climates of the Neilgherries, Anamallays, Pulneys, and probably Coorg, are admirably adapted to the production of quinine in these precious trees. On the other hand, it is possible that, under cultivation, the chinchonæ may be able to adapt themselves to conditions of climate differing as much from those of their native habitat even as the Mahabaleshwur hills, and that their cultivation is capable of far wider extension than I am now able to expect. It would be a source of gratification if chinchona plantations could be established in any part of the Bombay Presidency; and while Mr. Dalzell, the able Conservator of forests, superintends any experiments which may be made, it will certainly not be from a want of botanical knowledge or intelligent care, if his anticipations of success are not realised.[498]

CHAPTER XXVIII.

CULTIVATION OF THE CHINCHONA-PLANTS IN THE NEILGHERRY HILLS, UNDER THE SUPERINTENDENCE OF MR. McIVOR.

In previous chapters detailed accounts have been given of the proceedings connected with the collection of chinchona plants and seeds in South America, their conveyance to India, and the selection of suitable sites for their cultivation. It now only remains to record the progress of this important experiment in the Neilgherry hills during the last year, and to offer some remarks on the contemplated measures connected with its future management. A very valuable Report by Mr. McIvor, on the same subject, will be found in an Appendix.

It is a subject of congratulation that the Government should have at their disposal the services of one so admirably fitted for the post of Director of chinchona cultivation as Mr. McIvor. This gentleman has superintended the Government gardens at Ootacamund for fourteen years, and their beauty as well as their usefulness are due to him;[499] while his periodical visits to the Conolly teak plantations have been productive of the most valuable results,[500] and he has successfully introduced a great number of English and other plants into the Neilgherry hills.[501] Mr. McIvor combines with his attainments as a scientific gardener great practical experience, and a thorough acquaintance with the climates, soils, and flora of the hills. He has long taken a deep interest in the question of the introduction of chinchona-plants into India, and he brought the subject to the notice of Lord Harris, then Governor of Madras, as long ago as 1855. Since that time he has made himself master of the subject by a study of every work of any importance which has appeared in Europe within the last thirty years;[502] while the practical knowledge which he has acquired of the requirements of chinchona-plants during the fifteen months that he has now superintended their cultivation, in addition to his previous qualifications, makes him fitter than any other person that could be found for the direction of this most important experiment.

In July 1861 Mr. McIvor was appointed Superintendent of chinchona cultivation by the Madras Government, with full and entire control over the operations, in direct communication with the Government, and subject to no interference from any intermediate authority.[503] Orders to the same effect were sent out to Madras by the Secretary of State for India in Council on July 2nd, 1861, and the same orders were repeated both to the Governor-General and to the Governor of Madras, in despatches dated February 1862. It was above all things important that Mr. McIvor's position, in connexion with the chinchona experiment, should be authoritatively defined, in order to

protect him from attempts at interference, which have been as vexatious as they have been unnecessary, and which have more than once threatened to render success impossible. These dangers are now, fortunately, at an end; and the interest taken by Sir William Denison, the present Governor of Madras, in a measure calculated to confer so great a benefit on the people of India, ensures to it a fair trial, and is one of the best guarantees of ultimate success.

Mr. McIvor's zeal and ability, his intimate knowledge of his profession, of the Neilgherry hills, and of all questions bearing on the subject of chinchona-plants, and his acquirements as a scientific as well as a practical gardener, justify the confidence which has thus been placed in him by the Secretary of State in Council, and by the Madras Government. He has also had the advantage of personal intercourse, for weeks together, with Mr. Cross, Mr. Weir, and myself, after we had explored and carefully examined the chinchona forests in South America; but his subsequent experience in the cultivation of the plants under his charge has furnished him with means of observation which now gives his opinion greater weight than those of persons whose knowledge is derived from books, from short visits to the plantations in Java, or even from personal examination of the South American forests.

In offering my opinion on the best method of cultivating the chinchona-plants, I have the satisfaction of knowing that my conclusions substantially agree with those of Mr. McIvor—mine being founded on experience gained in the chinchona forests, and his on careful observation of the plants which he has reared in India. That these views should be concurred in by Dr. Weddell, Mr. Howard, and Mr. Spruce, is most satisfactory, as it supplies an additional presumption of their correctness.

I will now proceed to give an account of the progress of the chinchona cultivation in the Neilgherry hills. The first batch of seeds, being those of the "grey-bark" species from Huanuco, arrived at Ootacamund on the 13th of January, 1861, and those of the "red-bark" followed in the end of February. On the 7th of April 463 plants of *C. succirubra* and six of *C. Calisaya* reached their destination on the Neilgherry hills in very good condition, considering the length of time they had been in Wardian cases, and thus the experiment was fairly commenced.

The first sowing, which took place in January, was not very successful, because Mr. McIvor was induced to use too retentive a soil, having been misled by the treatment of seeds adopted in Java; and only 3 to 4 per cent. germinated. The second sowing took place early in March, the soil used being of a much freer nature, half composed of burned earth; and 15 to 25 per cent. germinated. Encouraged by this result, Mr. McIvor used a soil composed entirely of burned earth for the third sowing, which took place in the beginning of April, and included the seeds of the "red-bark" species. Of this sowing 60 per cent. germinated, and of the seeds of *C. micrantha* 90 per cent. It is to be remembered that all these seeds were collected in the South American forests some

months before, and that they had passed through the perils of several climates, and a voyage of many thousands of miles.

In May all the plants of *C. succirubra* had taken fairly to the soil, and were in a healthy and flourishing condition, those of *C. Calisaya* were doing well, but recovering more slowly from the effects of the voyage, and the seedlings were growing fast. The temperature given to the plants was 60° in the morning, rising to 75° in the day, with plenty of light and air; this treatment having proved to be best adapted for their rapid growth. Of course they would grow higher if shaded, and consequently drawn up, according to the erroneous plan adopted in Java; but this is not what is wanted, and, by giving them plenty of light and air, they grew into fine strong plants, as broad as they were long.

It was found that the chinchonæ are remarkably impatient of any damp at their roots, all the species thrive better in rough and open than in fine soil, and there is reason to believe that they will bear a much drier climate than we originally supposed.

During the autumn of 1861 the work of propagation, by means of cuttings and layers, progressed rapidly; and, whereas in June 1861 we only had 2114 chinchona-plants of valuable species at Ootacamund, in January the number was increased to 9732 plants. The layers of *C. succirubra* root sufficiently to be removed in five weeks, and cuttings in two months; layers of the "grey-bark" taking a little longer time to root, or about six weeks. Mr. McIvor has also made the important discovery that chinchonæ strike freely from *eyes*, and make beautiful plants exactly like strong seedlings. These *eyes* will give about eight fine strong plants for one that is obtained from cuttings, which is a great advantage while there is not much wood in the young plants. In October Mr. McIvor reduced the temperature of one of the propagating houses to 55° at night, and 65° during the day; and, under this treatment, which is also probably advantageous to the bark, the plants appeared to grow faster, and the leaves became a very beautiful bright green. The thickness of the bark, in the plants of *C. succirubra*, is very remarkable, having been in some instances nearly one-seventh of an inch last January, and in the smaller stems the average thickness of the bark considerably exceeds that of the wood. Mr. McIvor attributes the unusual thickness of the bark to the presence of a large number of healthy leaves, exposed to bright light. These leaves throw back into the bark a large quantity of highly elaborated matter. The experience of a year's cultivation convinced Mr. McIvor that, although the most suitable elevation and climate differs with the various species, yet that they all require a rich, rough, and very open soil. In September the erection of a new propagating house for chinchona-plants, in the Government gardens at Ootacamund, was sanctioned, which was completed early in December. It is 63 feet long by 21 broad, and will hold about 8000 plants.

The Dutch Government in Java, at the request of the Government of India, arranged to forward some chinchona-plants of the species cultivated in that island to Calcutta; and

accordingly 100 of *C. Calisaya*, 300 of *C. Pahudiana*, and 7 of *C. lancifolia* were transmitted. Of these 48 of *C. Calisaya*, 4 of *C. lancifolia*, and 250 of *C. Pahudiana* arrived at Ootacamund on the 20th of December, 1861. In exchange for these plants a supply of *C. succirubræ*, and a proportionate number of the other species, will be sent to Java, "not more in return for the valuable accession actually received to our stock of plants of *C. Calisaya*, than in acknowledgment of the very courteous and liberal spirit evinced by the Dutch authorities."[504] At about the same time Mr. McIvor also sent 100 plants of *C. succirubra* and 50 of each of the "grey-bark" species to Calcutta, with a view to the establishment of a chinchona plantation in the Sikkim or Bhotan hills.

The plants which arrived from Java were drawn and weak, and had evidently been grown without sufficient light. They were all more or less affected by rot at their roots, and many of the roots were covered with fungi. A few of the plants of *C. Calisaya* died, but the others recovered under Mr. McIvor's watchful care.

A large parcel of seeds of *C. Condaminea*, probably of two varieties (*Chahuarguera* and *Uritusinga*), and a smaller packet of seeds of *C. crispa*, were despatched from England in January, and arrived at Ootacamund in March, 1862. By this time Mr. McIvor had discovered the best method of treatment for chinchona-seeds. He sows in very sandy soil; and while so much water is never given as to make the particles of soil adhere to each other, yet the soil is kept in a uniform medium state of moisture. In this way the seeds not only germinate soon, but come up very strong. There is every reason to expect that a good per-centage of these seeds will germinate,[505] and that a large number of these, the earliest known of all the valuable chinchona species, will soon be growing luxuriantly in the upper *sholas* of the Neilgherry hills. Mr. Howard has also presented the Government with a plant of *C. Uritusinga* of Pavon (*C. Condaminea*, H. and B.), six feet high, which he had raised from seed sent to him from Loxa. This precious plant was embarked on board the steamer on the 4th of March, 1862, and arrived at Ootacamund early in April.

Thus, after two anxious years, we now have all the valuable species of chinchonæ mentioned in the second chapter, safely established in Southern India. In the following tabular statement will be seen at a glance the number of species, the number of each species, the number of plants last February, their monthly increase since June, their monthly growth, and their present dimensions. The number is now increasing at the rate of several thousands every month. The imported plants of *C. succirubra* have already produced some thousands by propagation; and in December the seedlings had attained a size sufficient to give wood for propagation, the first of them having even then produced a few hundred plants.

From the total number of 10,157 chinchona-plants must be deducted 425 of the worthless *C. Pahudiana* sent from Java, leaving a total of 9732 of valuable species on the 1st of February, with the number rapidly increasing. The increase was not so large

as it otherwise would have been during the first two months of 1862, owing to the supply of a number of plants to Java, and the transmission of others to Calcutta, with a view to the formation of a plantation in the Bengal hills, and of sixteen to Mr. Maltby for the Rajah of Travancore.

MONTHLY REPORTS of the Number and Growth of the CHINCHONA PLANTS on the Neilgherry Hills.

DATE.	C. SUCCIRUBRA.							C. Calisaya.	C. micrantha.	C. nitida.	C. Peruviana.	"Grey-bark" species without name.*	Growth of the seedlings of the "grey-bark" species.				C. CONDAMINEA.			C. lancifolia.	C. Pahudiana.	Total number of plants.
	Number of plants.	Average monthly growth.	Size of leaves.	Maximum monthly growth.	Height of largest plants.	Circumference of the stem of largest plants, at the ground.	Circumference of the stem of largest plants, 3 feet from the ground.						Average growth.	Maximum growth.	Size of leaves.	Height and breadth.	C. Uritusiega.	C. Chahuargueera.	C. crispa.			
1861.		Inches.	Inches.	Inches.	Ft. in.	Inches.	Inches.	Number.	Number.	Number.	Number.	Number.	Inches.	Inches.	Inches.	Inches.	A plant, 6 feet high, was despatched from England, for the Neilgherry hills, March 1862.	Upwards of 100,000 seeds arrived at Ootacamund in March 1862.	A small parcel of seeds arrived at Ootacamund in March 1862.	Number.	Number.	
June 9	967	..	..	..	..	..	..	6	511	430	28	172	..	..	..	3 high.				..	..	2114
July 9	1204	1½	11 ×7	..	2 6	..	..	6	802	714	36	211	1½	..	2½×1½	4½ high.				..	..	2973
Aug. 9	1517	1⅝	11⅛×7⅛	7	2 10	..	..	6	896	804	42	271	1½	2½	..	8½ by 7				..	..	3536
Sept. 9	2361	3	14¾×10	8	3 2	..	..	6	905	840	42	298	2	3½	..	13 by 10				..	..	4452
Oct. 9	3137	2½	15 ×10	11	3 6	..	..	6	905	854	58	298	1½	3½	..	15 by 12				..	21	5315
Nov. 1	3477	2½	16½×10	11	3 9	..	..	6	963	917	58	314	1½	3½	..	16 by 14				..	112	5947
Dec. 1	4762	2½	18 ×12	9	3 9	..	..	6	1228	917	64	314	1½	3½	..	16 by 15				..	175	7466
1862.																						
Jan. 1	5200	..	18 ×12	..	4 0	3½	..	59	1497	1050	64	314	..	..	..	..				4	425	8613
Feb. 1	6580	..	18 ×12	..	4 6	3½	2½	67	1713	1000	60	308	..	..	..	..				4	425	10,157
Mar. 1	..	..	..	..	..	..	..	116	..	..	..	..	..	..	..	..	..	138	..	..	..	..
Apr. 1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4193	100	..	..	25,000

* This is a variety of *C. nitida*.

It is exceedingly satisfactory to compare these results with those of the Dutch cultivators in Java. After *six* years they only had (exclusive of the *C. Pahudiana*, which is quite worthless) 8454 chinchona-plants of valuable species;[507] whereas in rather less than *one* year Mr. McIvor has reared 9732, without counting several hundreds which he has transmitted to Java, Calcutta, and Travancore. The Dutch have only introduced *two* good species, while we have obtained *nine*, exclusive of the four plants of *C. lancifolia* presented by the Dutch authorities. Thus, the average increase of valuable species of *chinchona*-plants in Java between 1854 and 1860 being at the rate of 1409 a year, the results attained in India have been nearly seven times as great as those of the Dutch cultivators. These facts are not mentioned in any spirit of undue exultation, but in order to show that it is not advisable slavishly to follow the methods of cultivation adopted by the Dutch, as two gentlemen, in official positions, who have recently visited the plantations in Java, appear to imagine. On the contrary, a system of cultivation diametrically opposed to that of the Dutch has enabled Mr. McIvor to achieve his present success; and the sites for plantations have been selected and prepared, not with any reference to the erroneous and comparatively unsuccessful systems pursued in Java, but on the principle of carefully comparing the elevations, temperature, amount of humidity, and of exposure of the mountains where the different valuable species of

chinchona thrive in South America, with analogous situations in the hills of Southern India.

The important process of planting out has now commenced in the Neilgherry hills, and it has been a subject of careful consideration whether the chinchona-plants should be grown under dense shade, under the partial shade of forest-trees, or quite in the open: in other words—what are the elevations and amounts of exposure best suited to the growth of the plants, and the development of their alkaloids?

In Java the chinchona-plants were at first established at far too low an elevation, in a wretched soil, and exposed to the full glare of the sun. Dr. Junghuhn, the present Superintendent, went to the other extreme, and, though the proper elevation has been ascertained, yet the error has been committed of forming the plantations in the dense shade of the forest, with the intention of allowing some trees to be drawn up in search of light, without a branch for thirty or forty feet, and of cutting them down for their bark in about forty years, and of grubbing up others in search of imaginary quinine in their roots.[508] I understand that this plan has at last been found to be erroneous, and that Dr. Junghuhn now directs all the trees in the vicinity of the chinchona-plants to be cut down, though faith is still maintained in the quinine-yielding roots of the worthless *C. Pahudiana*.[509]

If the thing was not sufficiently evident in itself, the appearance of the barks sent from Java to the Exhibition of 1862 is quite enough to prove that chinchona-plants ought not to be cultivated under the shade of forest-trees. The question of the proper amount of exposure to which each species should be subjected is, however, one which requires very careful consideration; as upon its correct solution depends the most important point of all, namely the method of cultivation which will be most profitable, and most suitable to the operations of private enterprise.

Mr. McIvor commenced experiments in planting out in the spring of 1861. In April he planted out three plants of *C. succirubra*, two under shade, and one in an open spot surrounded by brushwood and undergrowth. On the 29th of the same month the S.W. monsoon set in, and the plants under dense shade assumed a weak climber-like habit, and were injured from the leaves being cut to pieces by the constant drip from the forest-trees;[510] while the plant shaded by the brushwood continued in the most luxuriant state of health, with its leaves uninjured. In September 1861, six plants of different species were planted out in cleared spots on the highest and most exposed points of the Neddiwuttum site, and all of these have not only borne the cold and drought without injury, but their growth has never even been checked, and at present they are in the finest possible state of health. Their leaves are of the deepest green, some of them measuring 12 inches by 9.

Between May and August fifteen "red-bark" plants were planted out at Ootacamund. The unusual cold of December checked the growth of these plants, but did not injure them in the least, and the leaves still keep their deep-green colour, and measure from 7 to 9 inches.[511]

Early in January 1862, the formation of a nursery was commenced at Neddiwuttum, large enough for 300,000 or 400,000 Chinchonæ; and 2400 were planted out. 150 acres are to be planted, at the Neddiwuttum site, during the year; of which 75 acres will be planted under various degrees of shade from forest-trees, in order to ascertain the results of this method by actual experiment; and 75 quite in the open, the young plants being protected from the direct rays of the sun by artificial shade during the first year or two. The original stock will be retained in the gardens at Ootacamund, for the purpose of propagation, and the propagated plants will be used for stocking the nurseries and plantations.

With regard to the question of whether the chinchonæ should be planted out in dense shade of forest-trees or in the open, it will be well to recapitulate some of the information which has been collected in their native habitat in South America.

In the forests of Caravaya I observed that the plants of *C. Calisaya*, when in dense shade, were tall and weak, with few branches, and without any sign of ever having flowered or fruited. When very slightly shaded, as on the ridge of rocks above the Yanamayu, or scarcely at all, as on the precipice of Ccasa-sani, they spread more, have a more healthy appearance, and are covered with capsule-bearing panicles; while the most thriving and healthy-looking young plant that I met with, was growing in the open, without any shade whatever. It is quite certain that an abundance of light and air is an absolute necessity for the full development of the alkaloids in the bark of *C. Calisaya*, and that the trees must either grow at the edge of the forests, or else find their way to the light, by overtopping all other trees: otherwise, as is too often the case, they assume a weakly, straggling habit under the baneful influence of dense shade.

Dr. Weddell is of opinion that, during the first year or two, the soil and trunks of young trees of *C. Calisaya* should be protected from the direct influence of the scorching sun, as he had observed that plants so exposed generally appeared to have a stunted growth. He refers of course to the *Josephiana* or shrub variety of *C. Calisaya*, but their dwarfed habit must be attributed to the less fertile soil of the open grass-land in which they grow, and partly also to the great altitude, and consequently cold climate, rather than to effects of exposure to light and air.

With respect to the "red-bark" species, there cannot be a doubt that they should be planted in the open. On this point Mr. Spruce's observations are quite conclusive. He says—"The trees standing in open ground, pasture, cane-field, &c., are far healthier and more luxuriant than those growing in the forest, where they are hemmed in and partially

shaded by other trees; and while many of the former had flowered freely, the latter were, without exception, sterile. This plainly shows that, although the red-bark may need shade whilst young and tender, it really requires (like most trees) plenty of air, light, and room, wherein to develop its proportions."[512]

The "grey-bark" species all bear the marks of exposure to free air, cold, and sunshine; and the overspreading thallus of various *Grapideæ* on their barks indicates that the trees have grown in open situations, exposed to rain and sunshine.[513]

The *C. Condaminea* trees, in the neighbourhood of Loxa, grow sometimes in little clumps, and sometimes solitary, but always in dry situations.[514] Dr. Seemann, who visited Loxa when serving on board H.M.S. Herald, informs me that those which he saw, bearing ripe fruit, were on the edge of thickets, entirely exposed to the influence of air and sunshine.

Dr. Weddell assures me that he would never recommend that any of the chinchona-trees should be planted in the dense shade of the forest, as in such a situation the greater number would evidently soon be smothered. He is of opinion that the Chinchonæ, in India, should be planted in open ground; but he considers it important that the trunks and soil should be shaded during the first year or two. He proposes to effect this object either by planting the chinchonas at convenient distances in a quincunx, alternately with some more fast-growing trees, which might be cut away when no longer required;[515] or by planting the chinchonas themselves close enough to oblige each other to run up, sufficient space and air being gradually provided by judicious pruning and thinning out. The former method might be a good one if it were not for the faster-growing trees taking up a great proportion of the nourishment from the soil, which would be more profitably reserved for the chinchonas; and probably the efficient shading of the trees, while young and tender, will be more easily and effectually provided for by simple artificial means.

Mr. Howard, the author of '*Nueva Quinologia de Pavon*,' whose knowledge on all questions connected with chinchona-plants is not surpassed by that of any botanist in Europe, is clearly of opinion that they should be planted in the open, without shade from other trees, and that they should be cultivated as shrubs; when their branches will yield an ample and remunerative supply of bark.

On the other hand, Dr. Junghuhn, in Java, has planted his chinchonæ under the dense shade of forest-trees, where they must necessarily be watery and unhealthy, where they will not flower or bear fruit, and where he does not expect that they will yield quinine for fifty years, when he contemplates the entire demolition of the plantations by felling all the trees. Now, if such a system as this is to be adopted in India, the chinchona-plants might as well never have been introduced. The plantations would be a wasteful expense to Government, with a remote chance of some profit, forming but a small fraction of the outlay, about twice in a century; and the idea of chinchona cultivation

ever being undertaken by private enterprise, on this system, is quite out of the question; for what planter in his senses would commence the cultivation of a product which would yield him no return for forty or fifty years?

When planted in the open chinchonæ grow luxuriantly, yield abundant supplies of seed, and form fine thick bark, which, owing to the free exposure of the leaves to the influence of light and fresh air, contains a large per-centage of alkaloids; while, in the shade of forest-trees, they run up into tall, weak, straggling plants, with little chance of either bearing fruit, or elaborating much quinine in their bark, until, after nearly half a century, some of them at length overtop the other trees, and reach that essential sunshine of which they had been so long deprived.

I not only think, with Mr. Spruce, Dr. Weddell, Mr. Howard, Mr. McIvor, and Mr. Cross, that the chinchona-plants must be planted in the open, and freely exposed to the influence of fresh air and sunshine; but I am most strongly of opinion that, if the opposite system was unfortunately adopted, it would have been far better if the expense and trouble of introducing these precious trees into India had never been incurred.

It is true that, when planted in the forest, the chinchonæ will look well to the casual observer, and that their cultivation can be conducted without skill or care, as all will be left to nature; while, in open ground, it will require great skill and constant attention to get the young trees over the first year or two. The cleared ground will be exposed to the full effects of evaporation and radiation, and much judicious management will be necessary in applying artificial shade, and in adopting other precautions. The open spaces should not, I think, be of very great extent, without being broken up by clumps or irregular lines of trees; and care must be taken that the supplies of moisture and of water are not prejudiced by too much felling. But these details may safely be left to Mr. McIvor, who now has the assistance of two well-instructed English gardeners, named Batcock and Lyall; and he will be able to obtain uniform and constant yearly supplies of bark, without any damage to the trees, which, when once full-grown, will thrive luxuriantly, and yield abundance of seeds.

The most suitable positions for chinchona-plants, as regards elevation and climate, having been pointed out, and the best method of treatment with respect to exposure being decided in favour of planting out in open ground, two other questions remain to be discussed which are intimately connected with the above,—namely, the conditions under which the largest per-centage of febrifugal alkaloids will be formed in the bark, [516] and the method of cultivation which is likely to yield the largest and most remunerative supplies of bark in the shortest time.

One well-established fact, which is proved by universal experience, is that all the species of chinchona-trees produce the thickest bark and the largest per-centage of alkaloids when growing at the highest elevation at which they respectively flourish.

Thus, all other circumstances being favourable, the *C. Calisaya* and *C. succirubra* species will yield more profitable crops when growing at an elevation of 6000 feet, than at one of 5000 feet. The shrubby varieties of chinchonæ are specially good when their stunted growth is owing to the altitude of the locality.[517] Mr. Spruce ascertained, with regard to the "red bark," that the greater the height at which the tree grows, the larger is the proportion of alkaloids contained in the bark;[518] and that, although the trees growing nearest the plain were generally much larger, yet their bark was by no means so thick in proportion to their diameter as in trees higher up. He adds that, in cutting down trees in the hot plains, he has often been struck with the thinness of the bark compared to that of trees growing in temperate climates.[519]

There are several other conditions under which the largest amount of alkaloids is formed in chinchona-barks, which are as yet little understood. Dr. Karsten suggests that the content of alkaloids in the same species of chinchona-trees, growing in different ravines, is affected by unceasing mists in one, and constant sunshine resting on the vegetation in the other; the former impeding, and the latter promoting, the formation of quinine.[520] In the Loxa region a great difference has been noticed in the bark of *C. Condaminea*, according as the tree has grown on the sides of the mountains most exposed to the rays of the morning or of the evening sun: and Mr. Spruce remarks of the "red-bark" trees that the ridges on which they grow all deviate from an easterly and westerly direction, and that the trees are far more abundant on their northern than on their southern slopes. The northern and eastern sides of the trees had also borne most flowers, and scarcely a capsule ripened on their southern and western sides, except on one tree of more open growth than the rest. This phenomenon is due to the fact that the trees receive more sunshine from the north and east, during the summer mornings,[521] the afternoons being usually foggy.

All these points will receive careful attention from Mr. McIvor, in conducting the cultivation; and his observations will soon enable him to decide many points connected with the formation of quinine in the bark, and to ascertain the most advantageous conditions under which the plants should be cultivated.

The sites have been selected at Neddiwuttum and Dodabetta with reference to the similarity of elevation and climate in those localities to the native mountains of the species which it is intended to cultivate in them, and because they have plenty of deep loamy soil. It has also been determined that the best method of cultivation will be found in planting out the chinchonæ in the open, for reasons already given; and not only will the luxuriant and healthy growth of the plants be provided for by this treatment, but it is also essential for the formation of an abundant supply of alkaloids in their bark. This process depends on the vigorous action of the leaves, and the healthful condition of the leaves is due to a sufficient supply of sunshine. Dr. Lindley says,—"It is to the action of leaves,—to the decomposition of their carbonic acid, and of their water; to the

separation of the aqueous particles of the sap from the solid parts that were dissolved in it; to the deposition thus effected of various earthy and other substances, either introduced into plants as silex or metallic salts, or formed there, as the vegetable alkaloids; to the extrication of nitrogen; and, probably, to other causes as yet unknown—that the formation of the peculiar secretions of plants, of whatever kind, is owing. And this is brought about principally, if not exclusively, by the agency of light. Their green colour becomes intense, in proportion to their exposure to light within certain limits." [522]

Under cultivation the chinchona-plants must either be raised in their shrubby form in the open, or as tall trees under the shade of the forest. The latter system, which has been adopted by Dr. Junghuhn in Java, is defended on the ground that, in their natural localities in the Andes, the chinchonæ "grow in damp forests overshadowed by trees." There are two things to be said against this. Firstly, that it is not the case; for though it is true that some species of chinchonæ do grow in damp shady forests, yet they never flourish in such positions, but only when supplied with plenty of light and air; and secondly, even if it was the case, such an argument would be worth nothing. In their wild state, and in localities where they are indigenous, all plants find certain conditions which are favourable to their perfect development; but they have to struggle for existence with a multitude of neighbours. Every condition is not supplied by Providence for the special behoof of one particular genus, and, in virgin forests, all trees suffer more or less from being overcrowded and overshadowed. But under cultivation the case is different. The cultivator endeavours to combine all the conditions best calculated to ensure the perfect development of a particular plant, and does not subject it to the baneful influences of too much shade, merely because it suffered from overshading in its wild state. Mr. McIvor has very aptly illustrated this point, by mentioning that Bruce found wheat growing wild in Upper Egypt, struggling for existence with rushes and other weeds. An English farmer would be surprised if he was told to sow his wheat in the hedges, instead of in the fields, because in its wild state it is found amongst weeds and briars!

The facts that it will be necessary to wait for thirty years before any return can be expected; and that it will have a most injurious effect on the formation of alkaloids in the bark, are sufficient arguments against planting the chinchonæ in the shade of the forest, and waiting for them to run up until the survivors overtop the surrounding trees. It has been necessary to bring these points prominently forward, because attempts have been made to introduce the erroneous system, adopted by the Dutch cultivators, into India.

We now come to the other alternative, that of raising the chinchonæ in their shrubby form, on plantations in open clearings, with plenty of fresh air and sunshine. It is the system of cultivation which I, in common with Mr. Howard and Mr. McIvor, consider to

be the most likely to lead to successful results, because it is the only one by which remunerative harvests of bark can be obtained year by year, without injuring the plants.

Two questions require consideration before adopting this method: first, whether the chinchonæ in their shrubby form will yield a sufficient annual supply of febrifugal alkaloids to make the cultivation remunerative; and secondly, whether it will be possible to take the required quantity of bark every year, without checking the growth of the trees.

The trunk or *tabla* bark naturally yields a much larger per-centage of alkaloids than the *canuto* or small bark of branches; but as a supply of the former could only be obtained once in forty years, and then at the cost of destroying the plantations, while the latter will yield an annual harvest without any injury to the trees, this point is not of much consequence.[523]

The fact is that very little *tabla* or trunk-bark comes from South America, and that nearly the entire bark trade is supplied by quill-bark from the branches of shrubs. Some Calisaya bark from Bolivia, some "red bark," and "West-coast Carthagena," from the trunks of *C. Palton*, arrive in the form of large slabs of *tabla*-bark; but a great deal of the Calisaya and succirubra bark, the whole of the "crown-bark" from Loxa, and all bark from other quarters, is found only in the form of quills from small branches. I have measured several of the quills which come into the London market, and find that none of them have bark equal in thickness to that already attained by some of the young plants reared by Mr. McIvor at Ootacamund.[524] These quills are evidently taken from small shrubs, and they yield a very good per-centage of quinine. Several samples of quill Calisaya bark, sold in London in March 1862, contained four per cent. of quinine. Their bark was one-eighth of an inch thick, and the quills were just under an inch in circumference. In a cultivated state the yield will of course be much greater, and Mr. Howard, judging from the usual yield of quill-bark, is of opinion that a large produce may be annually realised by growing the chinchonæ as shrubs.[525]

In cultivating the chinchonæ in rows on cleared plantations it will probably be found advisable to grow them to a height of ten or twelve feet, and about twelve feet from each other, so that they may be able to spread out until they are nearly as broad as they are long; and they should be induced to branch as near the ground as possible. A certain number of the branches should be lopped annually for the quinine harvest; shoots would immediately be thrown out below the cuts, from which one or two should be selected to take the place of the lopped branch; and in about six years the new branches, thus formed, would be sufficiently grown to be again removed. In the mean while the same operation would have been going on with other branches, and thus an annual harvest of quill-bark may be obtained for any number of years. Mr. McIvor considers that this treatment will ensure a quick, uniform, and constant supply of bark; and if the lopping and pruning is judiciously conducted, the trees will be benefited rather than injured by

the annual removal of a few branches.[526] Chinchona-plants, like oaks and willows, might also be cultivated as pollards.

By cultivating the chinchona-plants on these principles, forming plantations in cleared open ground, giving the plants plenty of light and air, and obtaining annual harvests of quill-bark from the shrubs, quinine-yielding chinchona-bark will become an article of commerce within eight years from the first introduction of the plants into India. After the first harvest the supply will rapidly increase. Extensive Government plantations of the different species at Neddiwuttum and Dodabetta on the Neilgherries, will be in a position to supply any number of chinchonæ for private enterprise, and it is to be hoped that the Government will establish other chinchona nurseries on the Pulney hills, in Coorg, and eventually on the Anamallays.

As quinine-yielding bark is a more valuable product than coffee, there is every reason to believe that, as soon as the Government plantations are proved to be successful, many planters will undertake the cultivation; and I understand from Mr. McIvor that several persons have already expressed a desire to give the chinchonæ a trial, and that he expects to be able to distribute plants by June 1862.[527] Thus another important product will be added to the resources of India, while the Government will have an abundant and cheap annual supply of the most indispensable of all medicines to Europeans in tropical climates, which is now only obtained at immense expense, and in quantities quite insufficient to meet the demand.

In a commercial point of view the introduction of chinchona-plants into India is likely to prove very beneficial, by adding another valuable article of export to the numerous products of that favoured land; but an equal if not a greater result will be derived from this important measure, in the naturalisation of these healing plants in a country the inhabitants of which suffer so severely and constantly from intermittent and other fevers. From motives of humanity, as well as from personal interest, every coffee-planter, as I have before said, ought to cultivate a few rows of chinchona-plants in the upper part of his clearing. Even if it is not intended to rear them on account of their commercial value, yet such a measure recommends itself as a duty, in order to have a supply of this inestimable febrifuge constantly at hand for the use of those who are employed on the plantations.

Many of the natives are already fully aware of the febrifugal virtues of Peruvian bark, and it is to be hoped that, in all the hill-districts where there is a suitable elevation and climate, they will grow chinchona-trees in their gardens, just as is now generally done with coffee in all the villages in Coorg. For the use of the natives there will be no necessity to go to the expense and trouble of extracting the alkaloids, as the green fresh bark is itself very efficacious. After the natives have once used this unfailing remedy, and experienced the power it has over the fevers from which they suffer, they will, like Dr. Poeppig in the wilds of Peru, approach the beautiful healing trees with warm

feelings of gratitude,[528] their fame will spread far and wide, and the cultivation of chinchonæ will, I trust, be extended to its utmost limit throughout the peninsula of India.

So far as my observations extended, the impression which I had previously received, that the natives can with difficulty be induced to undertake the cultivation of any new plants to which they have not been accustomed, was not confirmed. Not to mention the potato, maize, tobacco, and capsicums, which originally came from America, and are now generally cultivated in India, it is a fact that in Wynaad upwards of 2000 acres are taken up for coffee cultivation by the natives; and in Coorg, where coffee was only introduced about six years ago, I scarcely saw a single hut to which a small coffee-garden was not attached. The extent to which the cassava (*Jatophra Manihot*), only lately introduced, is now cultivated in Travancore, is quite remarkable; and there is every reason to suppose that the natives will be equally ready to cultivate a plant possessing such extraordinary febrifugal powers as the chinchona, the value of which they will soon appreciate.

Thus will the successful cultivation of the quinine-yielding chinchona-plants confer a great and lasting benefit upon the people of India, as well as upon the commerce of the whole world; and the concluding words of Dr. Weddell's Introduction[529] may, therefore, with strict propriety, be applied to Mr. McIvor and his assistants: "Reste la ressource de la culture, et il faut l'employer. S'il est un arbre digne d'être acclimaté, c'est certes le Quinquina; et la postérité bénirait ceux qui auraient mis à exécution une semblable idée."

While speaking of the incalculable value of *quinine*-yielding chinchona-plants, it must be understood that I include those of the "grey-bark" species, which yield *chinchonine*; and it is the more important to dwell upon this, because a sentence in the Introduction to Mr. Howard's valuable work is perhaps calculated to give a different impression.[530] It is true that chinchonine will not command so remunerative a price in the London market; yet it produces effects on the system precisely analogous to quinine. To stop intermittent fever, doses of chinchonine require to be one-third larger than doses of quinine; but it is absolutely certain that the former is as good a febrifuge as the latter, and it costs infinitely less. Planters will of course, in the first instance, undertake the cultivation of those species which yield quinine, such as *C. succirubra*, *C. Condaminea*, *C. lancifolia*, and *C. Calisaya*; but the grey-bark species will yield barks which will afford valuable supplies to the Government hospitals; and their naturalisation all over the plateau of the Neilgherries and other hill districts will be a great boon to the natives. Hereafter the latter species will well repay the outlay and labour of cultivation. Even now there is a great demand for chinchonine; the chinchonidine of *C. Condaminea* is considered by Mr. Howard to be scarcely if at all inferior to quinine, and Dr. J. Macpherson thinks so highly of the value of chinchonine that he considers it to be of little importance whether the species introduced into India are rich in quinine or

chinchonine. This gentleman speaks from experience acquired by long practice in the East Indies.[531]

The following is a table of the largest amount of alkaloids extracted from, and the price in the London markets of the barks of species of chinchonæ now introduced into India: —

SPECIES.	Largest amount of alkaloids extracted from the bark.	Price in London per lb. of dried bark, in March, 1862.
		s. d.
C. Uritusinga	3·8 per cent. of quinine and chinchonidine	2 6
C. Chahuarguera	3·5 per cent.	
C. crispa	3·5 per cent.	
C. succirubra .. tabla	8·5 per cent., of which 5 per cent. was quinine	8 0
C. succirubra .. quill	5 per cent. of quinine and chinchonine	
C. Calisaya .. tabla	5 per cent. of quinine	4 6
C. Calisaya .. quill	3·5 per cent. of quinine	
C. nitida	2·2 per cent. of chinchonine	1 6
C. micrantha	2·7 per cent. of chinchonine	
C. Peruviana	3 per cent. of chinchonine	
C. lancifolia	5 per cent. of quinine and chinchonine	1 6

Price of quinine .. .. 8s. per oz.
„ chinchonine .. 1s. „ } in London in March 1862.

Under cultivation the barks may be expected to yield a much larger per-centage of alkaloids than they ever do in their wild state.

CHAPTER XXIX.

CHINCHONA-CULTIVATION.

Ceylon—Sikkim—Bhotan—Khassya Hills—Pegu—Jamaica—Conclusion.

THE complete success which has attended the cultivation of chinchona-plants in the Neilgherry hills, encourages the hope that similar happy results will follow their introduction into other hill districts of Southern India, which have been described in more or less detail in previous chapters. I have no doubt of the suitability of the Pulney hills, the Koondahs, the Anamallays, and Coorg for such experimental cultivation; and trials should hereafter be made on the Mahabaleshwurs, the high hills east of Goa, the Baba-bodeens, Nuggur, Wynaad, the Shervaroys, and the mountains between Tinnevelly and Travancore.

The hill districts of the island of Ceylon, which have the necessary elevation, and are within the region of both monsoons, also offer peculiarly favourable conditions for the cultivation of chinchona-plants, probably equal to the best localities on the peninsula of India. Mr. Thwaites, the Director of the Royal Botanical Gardens at Peradenia, takes a deep interest in this important measure, and under his auspices there can be no doubt of its ultimate success. It was from the first determined to send a portion of the chinchona-seeds to Ceylon, although the whole expense of the undertaking has been borne by the revenues of India, and no assistance whatever has been given by those colonies which will thus profit by its success.

The gardens at Peradenia are 1594 feet above the level of the sea, and the following table will give a correct idea of the climate:—

OBSERVATIONS taken at PERADENIA, in Ceylon, in 1857.

MONTH.	Thermometer.			Rainfall in inches.	REMARKS.
	Max.	Mean.	Min.		
1857.					
January	82	79.3	74.7	1.8	Fine and sunny. Cold dewy nights and foggy mornings.
February	82.5	79.8	76.5	1.3	Do. do. do.
March	84.2	82	77.5	5.8	A few showers of rain in the evenings.
April	86.5	81.9	77.5	8.4	Rain in the latter part of the month.
May	82.5	81.5	75	4.7	Showery, with occasional gales of wind.
June	82.5	81.1	75.5	6	Showery.

July	80.5	77.1	75.5	9.8	Continued rain.
August	81.5	79.2	77.5	6.4	Showery, with high winds.
September	82.5	78.8	75.5	7.2	Rainy.
October	81.5	78	74.5	14.9	Rainy, with occasional sunshiny days.
November	82	77.9	73.5	22.3	Heavy rain.
December	81.5	78.6	75.5	2.8	Fine. Cold nights and hot days.
				96	

It is evident that Peradenia is far too low and hot for chinchona cultivation. The *C. succirubra*, and some other species, would probably grow to fine large trees there, but the bark would be very thin, and would yield little or no febrifugal alkaloids. But there are many other localities in Ceylon admirably suited, from their elevation and climate, for this cultivation, and sites may be selected, well adapted to the different species, from 5000 feet to Pedrotallagalle, which is 8280 feet above the sea. Among these is the Government garden of Hakgalle, at Nuwera-ellia, which is 6210 feet above the sea, in a climate with an annual temperature of about 59° Fahr., and abundantly supplied with moisture. Here most of the chinchona-plants have been established under the superintendence of Mr. Thwaites, who is assisted in their cultivation by Mr. McNicoll, a zealous and intelligent gardener from Kew. Mr. Thwaites reported, last September, that the progress of the important experiment in the cultivation of chinchonæ was satisfactory.

In February 1861 the first instalment of chinchona-seeds arrived in Ceylon, being a parcel of the "grey-bark" species sent from the Neilgherry hills by Mr. McIvor; and soon afterwards a portion of the "red-bark" seeds was received. In April six plants of *C. Calisaya* were transmitted from Kew, but two only survived, and are now growing vigorously at Hakgalle. Last September eight cuttings had been taken from them, two of which had rooted. From the seeds received early in 1861, 800 plants had been raised last September, namely, 530 of *C. succirubra*, 180 of *C. micrantha*, 25 of *C. Peruviana*, 45 of *C. nitida*, and 60 of the "grey-bark" species without name.

In January 1862 I forwarded parcels of seeds of *C. Condaminea* and *C. crispa* to Mr. Thwaites; and early in March six Wardian cases filled with chinchona-plants, from the depôt at Kew, were shipped for Ceylon.

Chinchona cultivation in Ceylon has thus been fairly started. It is exceedingly gratifying to hear that many coffee-planters will be glad to try the experiment upon their estates; [532] and that Mr. Thwaites will shortly be in a position to distribute plants from the Hakgalle garden.[533]

Chinchona-trees, in their wild state, have never been found at a greater distance than one thousand miles from the equator, and they are essentially inter-tropical plants;

though they only flourish at considerable elevations above the sea. The reason appears to be that one of their chief requirements is a tolerably equable climate throughout the year, which the temperate zones, with their great differences of temperature between winter and summer, do not afford. For this reason sites were selected, in the first instance, both in India and Ceylon, within the tropics; and indeed this point was essential for the first experiments, because all the other conditions of the growth of chinchonæ could not have been found beyond the equatorial zone. Under cultivation, however, it is probable that, with other favouring circumstances, these plants might thrive within the temperate zone, at short distances from the tropic, and attention was naturally drawn to the hill districts of the Eastern Himalayas, in Bengal. The usefulness and importance of the introduction of the chinchonæ into India will be much enhanced if their cultivation can be extended to these regions, and attempts will, therefore, be made to form chinchona plantations in Sikkim, Bhotan, and subsequently in the Khassya hills.

The province of Sikkim,[534] at the base of the mighty Himalayan peak of Kunchinginga, consists entirely of the basin of the river Tista, which, with its tributaries, drains the whole country. Its position, opposite to the opening of the Gangetic valley, between the mountains of Behar on the one hand and the Khassya hills on the other, exposes it to the full force of the monsoon. Its rains are, therefore, heavy and almost uninterrupted, accompanied by dense fogs and a saturated atmosphere throughout the year. There are frequent winter rains accompanied by cold fogs, alternating with frost, hail, and snow. March and April are the driest months, but rains commence in May, and continue with little intermission until October. The bounding mountains are very lofty, and snow-clad throughout a great part of their extent; but the central range in Sikkim, which separates the Tista from its great tributary the Rangit, is depressed till very far into the interior. The rainy winds have thus free access to the heart of the province.

The snow-level is at 16,000 feet; and the mean monthly temperature of the English hill station at Darjeeling, which is 7430 feet above the sea, and in lat. 27° 3′ N., is as follows:—

Darjeeling.			
MONTH.	Mean temperature.	MONTH.	Mean temperature.
January	40	July	61.4
February	42	August	61.7
March	50.7	September	59.9
April	55.9	October	58
May	57.6	November	50
June	61.2	December	42

The annual rainfall is 122.2 inches.

Of course no chinchona-plant would flourish in such a climate; and in the latitude of 27° it will be necessary to seek for suitable sites in much lower situations than in the hill districts of Southern India, which are in corresponding latitudes to those of the chinchona forests. In the Neilgherries the sites have been selected at the same altitudes as those at which the plants are found in South America, but in the Eastern Himalayas the localities must probably be chosen upwards of a thousand feet lower for each species—the *C. Condaminea* and its companions perhaps at 5000, and the *C. succirubra* between 3000 and 4000 feet.

From the sea-level to an elevation of 12,000 feet Sikkim is covered with a dense forest, consisting of tall umbrageous trees, often with dense grass jungle, and in other places accompanied by a luxuriant undergrowth of shrubs. In the tropical zone *Myrtaceæ*, *Leguminosæ*, and tree-ferns are common, and the air is near saturation during a great part of the year. *Vaccinia* are found at from 5000 to 8000, and snow occasionally falls at 6000 feet. A sub-tropical vegetation penetrates far into the interior along the banks of the great rivers, and tree-ferns, rattans, plantains, and other tropical plants are found at 5000 feet, in the Ratong valley.[535]

I should conjecture that the extreme limit for the growth of the hardier species of chinchonæ, in Sikkim, will be found where their constant companions the tree-ferns and *Vaccinia* end, namely at 5000 feet; and that the best sites for such species as *C. Calisaya* and *C. succirubra* are about 1000 to 2000 feet lower, amidst the sub-tropical vegetation of the valleys.

Bhotan, which adjoins Sikkim on the east, is a mountainous district of much the same character. In its western part the mountain ranges are lofty and rugged, and the river-courses very deep and generally narrow. The climate is equable, and the humidity of the winter appears to increase in the part adjoining Sikkim. The steepness of the mountains, and the influence of the elevated mass of the Khassya hills to the south, make the lower slopes, which skirt the plains of Assam, drier than those more to the eastward. Deep narrow valleys carry a tropical vegetation very far into the interior of Bhotan, among lofty mountains capped with almost perpetual snow. These attract to themselves so much of the moisture of the atmosphere, that the bottoms of the valleys are comparatively dry and bare of forest. The flora resembles that of Sikkim.[536]

The Khassya hills in 25° N. lat. form an isolated mass, rising up from the plains of Assam and Silhet to a height of 6000 feet. They rise abruptly from the plains of Silhet to the south, and at 3000 feet tree vegetation ceases, and is succeeded by a bleak stony region, with a temperate flora, up to 4000 feet, where the English station of Churra Poorji is built. The table-land is here three miles long by two, to the eastward flat and stony, and to the west undulating and hilly. On the south there are rocky ridges of limestone. The southern side of the hills is exposed to the full force of the monsoon, and the rainfall is excessive, as much as 500 or 600 inches annually. Further in the interior

the fall is less, and it gradually decreases until the valley of Assam is entered. This great rainfall is attributable to the abruptness of the mountains to the south, which face the Bay of Bengal, and are separated from it by 200 miles of Jheels and Sunderbunds. The heavy rains on the Khassya hills are quite local, as in Silhet the fall is only 100 inches. The plateau presents a bleak and inhospitable aspect, and there is not a tree, and scarcely a shrub to be seen, except occasional clumps of *Pandanus*. This desolation is caused by the furious gales of wind, and the extraordinary amount of rain which washes off the soil. The valleys are open, though with deep flanks, and the hill-tops are broad. The grassy slopes to the north are covered with clumps of shrubby vegetation, and the forests are confined to sheltered localities. Though the rainfall on the southern side is 600 inches, twenty miles inland it is reduced to 200 inches. The mean annual temperature of Churra Poorji is 66°, and in summer the thermometer rises to 88° and 90°. To the westward of the Khassyas lie the Garrows, which do not attain a greater height than 3000 to 4000 feet.[537]

The flora of the Khassya hills bears a greater resemblance to that of the hills in Southern India than to the Sikkim and Bhotan types. Genera and species forming masses of shrubby vegetation are identical with those of the Neilgherry *sholas*. It is probable that chinchona-plantations, especially of *C. succirubra*, might hereafter be formed advantageously on the northern slopes of the Khassyas, but it is evident that the best chances of success for the species growing at great altitudes, in South America, are offered in the Himalayan districts of Sikkim and Bhotan.

With a view to the establishment of chinchona-plantations in the Eastern Himalayas, plants have been forwarded by Mr. McIvor to the Botanical Gardens at Calcutta. On January 19th, 1862, there were at Calcutta 91 plants of *C. succirubra*, all except four supplied by Mr. McIvor; six of *C. Calisaya* from Java, and 133 of "grey-bark" species, of which 106 were supplied by Mr. McIvor, and twenty-seven were raised from the original South American seeds. Altogether there were 230 of the valuable species of Chinchonæ, besides fifty-nine of the worthless *C. Pahudiana*. It is intended to commence a chinchona plantation on the lower and outer range of Darjeeling in Sikkim at once, with a propagating-house on the model of Mr. McIvor's at Ootacamund; and afterwards to form a nursery for species growing at lower elevations on the Khassya hills.

There is another region in our Eastern dominions where suitable localities may be found for the cultivation of chinchona-plants, but it is as yet too little explored, and the difficulties of obtaining supplies, labour, and transport would be too great at present to allow of the possibility of forming plantations for some years to come. I allude to the recently formed province of Pegu. Dr. Brandis, the Conservator of Forests in Pegu, reports that it will be preferable to delay the introduction of chinchona-plants into that province, until their cultivation shall have proved successful in other parts.

In Pegu there are four great mountain ranges, running parallel with the sea-coast, which separate the valleys of the principal rivers. Commencing from the eastward, the first range is the Arracan-Yomah, dividing Arracan from Pegu, which is not higher than 4000 feet. The Pegu-Yomah, the principal seat of the Pegu teak, which separates the valleys of the Irrawaddy and the Sitang, only has a mean elevation of 2000 feet. The third range consists of the Martaban and Tenasserim coast-ranges, and barely attains a height of 5000 feet. The fourth and most eastern range, forming the watershed between the Sitang and Salween rivers, extends into the large and compact mountain mass of Yoonzaleen, to the south-east of Toungoo. The area of this lofty region is a hundred square miles, and several peaks rise to a height of 7000 and 8000 feet above the sea. The rains are heavier on these hills than on the adjacent plains, and the temperature is much cooler and more uniform. The formation consists of granite, gneiss, and quartzite. Up to 3000 feet the vegetation is of a tropical character, at which elevation teak disappears, and pines (*Pinus Khasyana*) begin, and go up to 5000 feet on dry gravelly soil. There are plenty of small mountain streams on these hills, with running water throughout the year; and the valleys and slopes are covered with evergreen forest.[538]

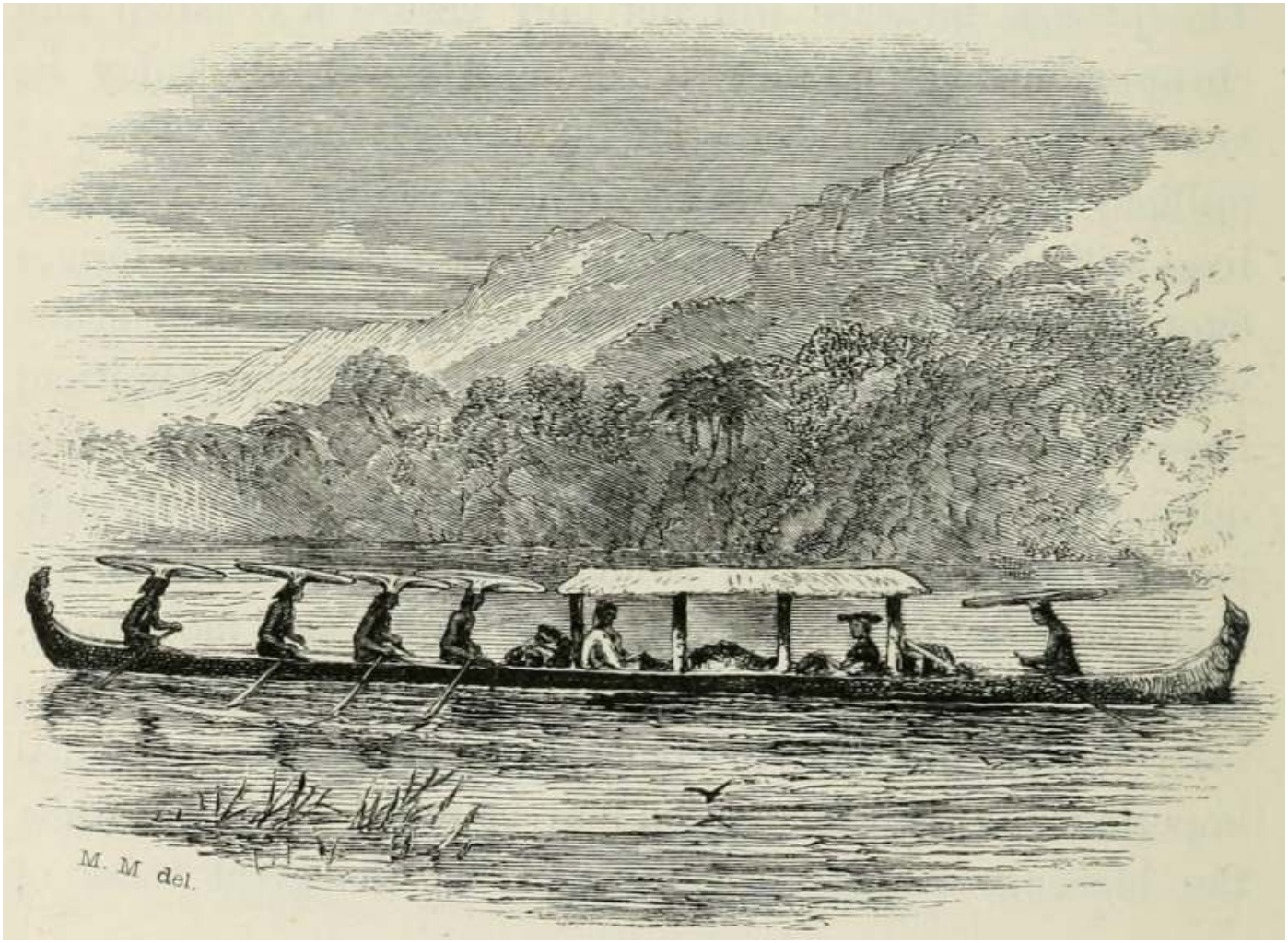
The Yoonzaleen hills are doubtless the best localities for chinchona-plantations in Pegu, but as yet there are no facilities for taking any steps with a view to the introduction of these inestimable trees, which will hereafter be as great a blessing to the fever-haunted jungles of Pegu as to those of India. The Yoonzaleens are forty miles from the town of Toungoo, which is at a distance of fifteen days of river navigation from Rangoon; and until a Sanatarium is formed on those hills, or some European settlers have established themselves there, it will be useless to attempt the introduction of the chinchona-plants. Before many years, however, it is to be hoped that plantations on the Yoonzaleen hills will supply quinine-yielding bark to the inhabitants of the plains of Pegu.

In a former chapter I stated that I gave directions for the transmission of a supply of seeds both of the "grey" and the "red-bark" species to two of our West Indian islands—Trinidad and Jamaica. In Trinidad they did not germinate, but in Jamaica, under the watchful care of Mr. N. Wilson, the Superintendent of the Botanical Gardens in that colony, they came up plentifully. By the spring of 1861 Mr. Wilson had a good stock of all the species in the gardens on the sweltering plains, where the "grey-bark" species naturally began to die off, but the *C. succirubra* plants were doing well, and sixty of them were quite strong enough to be planted out early in June. On the 4th of June, 1861, Mr. Wilson removed 120 plants, 60 of *C. micrantha* and 60 of *C. nitida*, to the foot of Catherine's Peak, which is 4000 feet above the sea. Here he was obliged to leave them, as the Jamaica Government had furnished him with no efficient assistant. In November he reported that the plants of *C. succirubra* were doing well, and by the latest accounts, dated March 24th, 1862, all the plants were thriving; but the chinchona experiment is not likely to succeed in Jamaica, owing to the listless apathy of the legislators of this colony. They have taken no steps to supply Mr. Wilson with assistant-gardeners, have

allotted no land in suitable localities as sites for chinchona-plantations, and have thus neglected to secure the successful introduction of a product which would have enriched the island, when the means of doing so were placed gratuitously at their disposal by the Secretary of State for India.

In our Eastern possessions the successful cultivation of quinine-yielding plants in the hills of Southern India, in Ceylon, and in the Eastern Himalayas, will undoubtedly be productive of the most beneficial results. Commercially this measure will add a very important article to the list of Indian exports; the European community will be provided with a cheap and constant supply of an article which, in tropical climates, is to them a necessary of life; and the natives of fever-haunted districts may everywhere have the inestimable healing bark growing at their doors.

It is impossible to exaggerate the blessings which the introduction of chinchona-cultivation will confer upon India. Since quinine has been extensively used among the troops in India, there has been a steady diminution of mortality; and whereas in 1830 the average per-centage of deaths to cases of fever treated was 3.66, in 1856 it was only one per cent. in a body of 18,000 men scattered from Peshawur to Pegu.[539] The present measure will not only ensure a constant and cheap supply of quinine to those who already enjoy its benefits, but it will also bring its use within the means of millions who have hitherto been unable to procure it. Many lives will thus annually be saved by its agency. In former ages its use would perhaps have changed the history of the world. Alexander the Great died of the common remittent fever of Babylon, merely from the want of a few doses of quinine.[540] Oliver Cromwell was carried off by ague, and, had Peruvian bark been administered to him, which was even then known in London, the greatest and most patriotic of England's rulers would have been preserved to his country. In time to come the lives of men of equal importance to their generation may be saved by its use, while the blessings which it will confer on the great mass of mankind, and especially on the inhabitants of tropical countries, are incalculable. The introduction of chinchona-plants into our Eastern possessions will be the most effective measure which could have been adopted to ensure a permanent and abundant supply of febrifugal bark; and a debt of gratitude is, therefore, due from India to Lord Stanley, who originated it, and to Sir Charles Wood, who has sanctioned all the necessary arrangements, until this great enterprise has finally been crowned with complete success. To Mr. Spruce, as the most successful collector in South America, and to Mr. McIvor, who has so ably and zealously conducted the cultivation in India, the chief credit of having achieved so important a result is due; but the author may be allowed to express his deep satisfaction at having been one of the labourers in this good work, where all have worked so zealously.



CANOE ON THE BEYPOOR RIVER.

See page 351.

APPENDIX A.

GENERAL MILLER, AND THE FOREIGN OFFICERS WHO SERVED IN THE PATRIOT ARMIES OF CHILE AND PERU, BETWEEN 1817 AND 1830.

WHEN the war of independence broke out in South America, many gallant spirits were attracted from different countries of Europe to fight for liberty and justice against Spanish oppression. Fired with enthusiasm for the cause of liberty, these knights errant, many of whom had been distinguished in the wars of Napoleon and Wellington, went forth to risk their lives for an idea. That they were in earnest is proved by the fact that, out of the whole number of sixty-seven, as many as twenty-five were killed or drowned, and eighteen were wounded.

In this band of brave adventurers, next perhaps to Lord Dundonald, the late General Miller takes the most prominent place, as one of the ablest, the truest, and the best. There is a halo of romance round all who joined in this crusade for liberty; all passed through many strange adventures, and did honour to the land from which they hailed; but the lamented old warrior who went to his rest last year was pre-eminent amongst his gallant companions, for his many acts of chivalrous daring and bravery.

William Miller, a native of Kent, served in the British Field Train Department of the Royal Artillery, during the Peninsular war, under Lord Wellington. He was present at the sieges and storming of Ciudad Rodrigo, Badajoz, and San Sebastian, at the battle of Vittoria, and investment of Bayonne. He had charge of a company of Sappers and Miners in the American war, was within a few yards of General Ross when he received his death-wound near Baltimore, and was also present at the attack upon New Orleans in 1814.

In 1817, having been placed on half-pay, and tired of an inactive life, he proceeded to South America, and offered his services in the war against the Spaniards. He was appointed Captain of artillery by the Government of the United Provinces of Rio de la Plata, crossed the Andes into Chile, and saved two pieces of artillery, under a heavy fire, at the battle of Talca, in March 1818. In April he became a Major, and assisted with his regiment at the declaration of Chilian independence on September 18th, 1818. In 1819 he commanded the Marines in Lord Cochrane's squadron, and in March an explosion of gunpowder, on the island of San Lorenzo, in Callao Bay, shattered one of his hands to pieces, injured his face, and caused blindness for many days. In October he was again at the head of his men, leading them to victory at Pisco, when he was pierced

by two balls, one passing through his liver, and another through his breast. In February 1820, though still weak and suffering from his former desperate wounds, he headed the storming party in the boats, in the gallant attack and capture of the forts of Valdivia in Chile, where he was again wounded in the head; and in the subsequent attempt on Chiloe he received a ball through his left groin, and a cannon-shot broke one of his feet. In May 1821 he landed in Peru, and defeated the Spaniards in the hard-fought battle of Mirabe; in 1823 he conducted a most adventurous and romantic campaign through the whole range of the deserts of Peru, from Arequipa to Pisco, defeating the Spaniards, with greatly inferior numbers, on several occasions; and in the same year he became General of Brigade.

In May 1824 General Miller received the command of the Peruvian cavalry of Bolivar's liberating army, and took a principal part in the victory of Junin in the following August. Soon afterwards he assumed the command of the whole of the cavalry of the liberating army, at the head of which he charged, and routed the division of General Valdez in the glorious battle of Ayacucho, at a most critical moment. This brilliant action was fought on the 9th of December 1824, and decided the fate of the war, the entire Spanish army of 10,000 men under General La Serna, Viceroy of Peru, being utterly routed. In February 1825 he was Prefect of Puno, and in April of Potosi; but in 1826 he returned to England on leave of absence, to cure himself of his wounds, which still caused him great suffering.

After a stay of some years in England he returned to Peru in June 1830 but, owing to the factious outbreaks in which he did not choose to take part, he again obtained leave of absence in 1831, and visited many of the islands of the Pacific Ocean, especially the Sandwich and Society groups, of which he wrote a most interesting account; and only returned to Peru after the constitutional election of General Orbegoso as President of the Republic. In the early part of 1834 he served in a campaign against the revolutionary chief Gamarra; and, though defeated at Huaylacucho, his operations were on the whole successful, and he was promoted to the rank of Grand Marshal of Peru on June 11th, 1834.

In October 1834 he was appointed Military Governor of Arequipa, Puno, and Cuzco; and it was at this time that he conceived the idea of forming a military colony in the valleys to the eastward of Cuzco, on the banks of some of the tributaries of the great river Purus. In March 1835, while on the point of setting out on an exploring expedition, a revolution broke out in Cuzco, and he was arrested by Colonel Lopera. He was, however, allowed to set out on his expedition, with two companions and seven Indians. He penetrated on foot to a greater distance to the eastward of Cuzco, on this occasion, than has ever been done before or since.

In September 1835 he again placed himself under the orders of the Constitutional President Orbegoso, and in February 1836 he captured Salaverry and eighty officers of

his revolutionary army by a very clever stratagem, near Islay. Shortly afterwards Santa Cruz established the Peru-Bolivian Confederation, and General Miller was sent as Minister Plenipotentiary to Ecuador, where he signed a treaty of peace and amity between that Republic and the Confederation. In August 1837 he became Governor of Callao, when all customs duties were reduced one half, smuggling ceased, and the receipts were soon quadrupled. He organized an efficient police; made a subterraneous aqueduct 3 feet wide, 3½ deep, and 280 yards long, for supplying Callao with water; commenced the erection of a college; and formed a tramway for the conveyance of goods from the mole to the custom-house. The people of Callao still look back with satisfaction and gratitude to the period when General Miller was their Governor.

In February 1839, on the overthrow of the Peru-Bolivian Confederation, General Miller was banished with many other able and distinguished men, whose names were taken off the army list by a decree dated in the following March. This unjust and illegal act was cancelled by a law of Congress dated October 1847.

After leaving Peru in 1839, General Miller was appointed in 1843 H. M. Commissioner and Consul-General for the Islands in the Pacific. In 1859 he revisited Chile and Peru, partly for his health, and partly to obtain the payment of his large arrears from the Government. When he arrived in Peru the Vice-President Mar, while the President, General Castilla, was absent at Guayaquil in 1859, reinstated him on the army list of Peru, by a decree dated December 9th, the anniversary of the battle of Ayacucho, and granted him his current pay as a Grand Marshal of Peru, and he continued to reside at Lima until his death on the 31st of October 1861. It is satisfactory to be able to record, for the honour of the Peruvian nation, that the whole of his claims were acknowledged in Congress in a most handsome way, and without a dissentient voice. But unfortunately the executive in Peru is still able to set the laws passed by the representatives of the people at defiance; delays and evasions were resorted to by Castilla, and the last days of one from whom Peru had perhaps received as valuable services as from any of her own sons, were embittered by the treatment which he experienced from the President of the Republic.

General Miller was a man of whom England may well be proud. He was one of those characters who combine great ability and extraordinary daring, almost amounting to rashness, with modesty and diffidence. If there was any fault to be found in any part of General Miller's former career, in the camp or in the cabinet, it would be from himself that it would first be heard. To his bravery and prowess, his body riddled with bullets, and the history of South American independence, bear testimony; to his administrative ability the gratitude of the people of Callao and Cuzco is the witness; his pure standard of honour, his scrupulous integrity, his warmth of heart, and single-mindedness are known to a wide circle of sorrowing friends; but of his numerous acts of self-denial and

charity few can tell, for he was one who let not his left hand know what his right hand did.

In person he was more than six feet high, and when young he was remarkably handsome; his features and shape of the head being of a thoroughly English type. In society he was exceedingly agreeable to the last; his conversation was always interesting, and often very instructive; and there was a peculiarly gentle and winning expression in his eyes. He took a deep interest in the attempt to introduce chinchona cultivation into India, and I was indebted to him for much valuable advice, and for many letters of introduction which were of great service to me. He also supplied me with most of the material which has enabled me to write the narrative of the insurrection of Tupac Amaru, the last of the Incas, forming the ninth chapter of the present work.

His memoirs, published by his brother many years ago, give by far the fullest and most interesting account of the war of independence in Chile and Peru, though the work of Garcia Camba, a Spanish general, is the best military history.

General Miller breathed his last on board H.M.S. 'Naiad' in Callao Bay, on the 31st of October 1861; and the remains of the gallant old warrior were interred in the cemetery at Bella Vista, with all the honours which the Peruvian Government could bestow. While the body was being embalmed, two bullets were found in it, and twenty-two wounds were counted on different parts of his frame. The most gratifying incident on the occasion was that the people of Callao, who had never forgotten the good he had done them as their Governor, insisted on carrying the coffin.

One of the last things on which General Miller was employed was the compilation of the list of his brave companions in arms. Such a list, I believe, has never appeared before; and as the employment interested and amused him during a time of much harassing annoyance, it gives me great pleasure to be able to insert it here, in order that his labour may not have been entirely in vain.

A List of Foreign Officers, Europeans (not Spaniards) and North Americans, who served in the patriot armies in Chile and Peru, between the years 1817 and 1830, showing the killed, wounded, and not wounded.

[The rank specified is that which each officer held when killed, or in 1830.]

Killed.

Major-Gen. Frederic Brandsen (French).—Served on the staff of the French army under Prince Eugène. Killed at the battle of Ituzaingo, Feb. 20, 1827.

Major-Gen. James Whittle (Irish).—Was present at the battles of Junin and Ayacucho. Killed in suppressing the mutiny of a battalion near Quito in 1830.

Colonel Charles O'Carrol (Irish).—Served in the British and Spanish armies in the Peninsula. Killed in an encounter with the Araucanians at Pangal in 1831.

Colonel William Ferguson (Irish).—Present at the battles of Junin and Ayacucho. Killed in defending General Bolivar from assassins at Bogota on September 25th, 1828.

Colonel Peter Raulet (French).—Was a cornet in the French cavalry at Badajoz, when that place was taken by storm on April 6th, 1812, and remained a prisoner of war in Scotland until the peace of 1814. Married and left children in South America. Killed at the battle of the Portete, Feb. 27th, 1829.

Colonel William de Vic Tupper (Guernsey).—Married and left children in the country. Killed at the battle of Sircay, April 17th, 1830.

Lieut.-Col. James A. Charles (English.)—Served in the Brigade Royal Artillery, and joined the Lusitanian Legion under the late General Sir Robert Wilson in Portugal in 1808. Upon Sir Robert being appointed Military Commissioner with the Russian army, he served as his aide-de-camp in the campaigns of Russia and Germany, and received the crosses of St. George of Russia, of Merit of Prussia, and of Maria Theresa of Austria. Killed in the action of Pisco on November 7th, 1819.

Lieut.-Col. Charles Sowersby (German).—Killed in the action of Junin, August 6th, 1824.

Major William Gumer (German).—Killed at the battle of Ica, April 7th, 1822.

Major Thomas Duxbury (English).—Present at the battle of Junin. Killed in the affair at Matara, Dec. 3rd, 1824.

Captain Quitospi (Russian).—Killed in an encounter with the Araucanians on the Bio-Bio, 1818.

Captain Joseph Borne (Irish).—Married, and left children in the country. Killed in an encounter at Arauco, May 1820.

Captain John B. Gola (French).—Killed in an encounter at San Carlos, 1821.

Captain Robert Bell (English).—Killed at the battle of Sircay, April 17th, 1830.

Lieut. Charles Eldredge (U.S.).—Killed at the assault of Talcahuano, December 6th, 1817.

Lieut. Ernest Bruix (French), son of Admiral Bruix.—Killed in an encounter with the Araucanians on the Bio-Bio, January 1819.

Lieut. —— Gerard (Scotch).—Killed at the battle of Cancha-rayada, March 19th, 1818.

Lieut. Le Bas (French).—Killed in the affair of Biobamba, April 22nd, 1822.

Lieut. Chris. Martin (English).—Killed near Ayacucho in 1824.

Cornet Danviette (French).—Killed in an encounter at Caucato near Pisco, in 1822.

Surgeon William Welsh (Scotch).—Killed in the action of Mirabe, on May 21st, 1821.

Total Killed .. .. 21.

Wounded.

Lieut.-Gen. Wm. Miller (English).—(See ante.)

Major-Gen. Francis B. O'Connor (Irish).—Brother to the late Fergus O'Connor. Was for some time Chief of the Staff of the Liberating Army, and was present at the battles of Junin and Ayacucho; was wounded at Rio de la Hacha in 1820. He is now residing on his estate at Tarija, in Bolivia. Married and has children in the country.

Major-Gen. Arthur Sands (Irish).—Wounded at the battle of Pantano de Bargas, July 25, 1819. Was present at the battles of Junin and Ayacucho. Died at Cuenca in 1832.

Major-Gen. Daniel F. O'Leary (Irish).—Wounded at Pantano de Bargas. He was Aide-de-Camp to General Bolivar in Columbia and Peru, and subsequently H.B.M. Chargé d'Affaires and Consul General at Bogota, where he died in 1854, having married and left children in the country.

Major-Gen. Philip Braun (German).—Present at the battle of Ayacucho. He was wounded at Junin, August 6th, 1824. He married in the country, and now resides in Bolivia.

Colonel George Beauchef (French).—Was at the battles of Austerlitz, Jena, Marengo, and Friedland. Wounded at the assault upon Talcahuano, December 6th,

1817. Died in Chile 1840, having married and left children in the country.

Lieut.-Col. Edward Guitekue (German).—Wounded in the action of Pisco, November 7, 1819. Died in Chile 1857. Married and left children in the country.

Lieut.-Col. Eugène Giroust (French).—Wounded at the cutting-out of the 'Esmeralda' under the fortresses of Callao, Nov. 5th, 1820. Was page to King Jerome; served in the French Horse Artillery; was made prisoner at the crossing of the Beresina, and sent to Siberia. Married in Peru, and is now residing at Lima.

Captain Philip Marguti (Italian).—Wounded at the battle of Maypo, April 5th, 1818. Died in Chile 1848.

Captain Henry Ross (U.S.).—Wounded at the battle of Yerbas-buenas, March 31st, 1813. Died in Chile.

Captain George Brown (English).—Present at the battle of Junin. Wounded at Ayacucho, Dec. 9th, 1824.

Captain James Lister (English).—Wounded in the affair of Rio Hacha in 1820. Died at St. John's, New Brunswick.

Captain Henry Hind (English).—Wounded in an attack on Callao, Oct. 2nd, 1819. Since dead.

Captain W. Kennedy (Jamaica).—Wounded in an encounter at Rio Cuarto, where both his eyes were shot out in 1821. Died some years afterwards in the United States.

Captain Danl. L. V. Carson (U. S.).—Wounded at the assault upon Talcahuano, Dec. 6th, 1817. Married and left children in the country. Died in Chile.

Captain Henry Wyman (English).—Present at the battle of Junin; wounded at Ayacucho in 1824. Is now residing in England. Married in South America.

Lieut. John Heldes (German).—Wounded at the battle of Cancha-rayada, March 19th, 1818. Since dead.

Lieut. James Lindsay (English).—Belonged to the expedition under General Beresford. Wounded at the battle of Maypo, April 5th, 1818. Married and left children in the country.

Total Wounded .. .. 18.

Not Wounded.

LIEUT.-GEN. MICHAEL BRAYER (French).—Was present at the assault of Talcahuano, Dec. 6th, 1817, and in the battle of Cancha-rayada, March 19th, 1818. He then returned to France, was reinstated in his former rank of General of Division, and was created a Peer of France.

MAJOR-GEN. JAMES PAROISSIEN (English).—Was Surgeon-General to the Buenos-Ayrean army under General Belgrano in 1814, and to the army of the Andes, under General San Martin, at the battles of Chacabuco, Feb. 12th, 1817, and Maypo, April 5th, 1818. Was appointed Aide-de-Camp to General San Martin, and became Major-General in 1821. Associated with M. Garcia del Rio, proceeded from Lima to Europe on a political mission in 1822, returned to Peru in 1825, and died on his passage from Callao to Valparaiso in 1826.

COLONEL JOHN O'BRIEN (Irish).—Served at the siege and taking of Montevideo and campaign in the Banda Oriental in 1814; was Aide-de-Camp to General San Martin in the battles of Chacabuco and Maypo; withdrew from active service while with the army in Peru in 1822. Joined General Santa Cruz a short time previous to the battle of Yanacocha, at which he was present, August 12th, 1835. He became a Major-General, and died in 1861.

COLONEL BELFORD H. WILSON (English).—Son of the late General Sir Robert Wilson; was Aide-de-Camp to General Bolivar from 1823 to 1830; subsequently H.B.M. Chargé d'Affaires and Consul General at Lima and at Caraccas. Was appointed a K.C.B. Died in London in 1858.

COLONEL ALBERT B. D'ALVE (French).—Son of the French General of the same name. Served in the campaigns in Spain and Russia, 1809 and 1813, and was at the battle of Waterloo in 1815. Died at Valparaiso 1821. Married and left children in the country.

COLONEL BENJAMIN VIEL (French).—Served in the French army encamped at Boulogne in 1804, and commanded a squadron of cavalry at the battle of Waterloo 1815. Is now a Major-General in Chile.

COLONEL JOSEPH RONDISONI (Italian).—Is now a Major-General in Chile.

COLONEL CLEMENT ALTHAUS (German).—Was present at the battle of Junin. Became a Major-General and died at La Concepcion in Peru, having married and left children in the country.

COLONEL SALVADOR SOYER (French).—Was Commissary to the navy, afterwards Aide-de-Camp to General Gamarra, and for some time charged with the Ministry of War. Married and left children in the country. Died at Lima.

LIEUT.-COL. LEWIS CRAMMER (French).—Retired from the army 1818; was afterwards murdered with his wife and family by the Patagonian Indians.

Lieut.-Col. Alexis Bruix (French).—Son of Admiral Bruix; was page to Napoleon I. Was present at the battle of Junin. Was killed by accident at Lima in 1825.

Lieut.-Col. Charles Wood (English).—Married and left children in Chile. Died in England while on leave of absence in 1856.

Major Michael O'Carrol (Irish).—Died in Chile in 1839, having married and left children in the country.

Captain William Smith (English).

Captain Miller Hallowes (English).—Was present at the battles of Junin and Ayacucho. Married and resides in the United States.

Captain William Harris (Irish).—Is now living at Cuenca, in Ecuador.

Captain John Rodriguez (English).—Married and left children in the country. Died at Callao.

Captain Robert Young.—Belonged to the 71st under General Beresford. Died in Chile.

Lieut. Maguan (French).—Retired in 1818, and was subsequently killed in a duel in France.

Lieut. Count Lucien Brayer (French).—Served as Aide-de-Camp to his father, General Brayer, in Chile.

Staff-Surgeon Thomas Foley (Irish).—Dead.

Staff-Surgeon Charles Moore (English).—Present at Junin. Dead.

Staff-Surgeon Hugh Blair (Irish).—Dead.

Staff-Surgeon Michael Crawley (Scotch).—Dead, Sub-prefect of Lampa, under General Santa Cruz, in 1837.

Total .. .. .. 24.

Drowned at sea off Chiloe, in 1823, while prisoners of war on board a Spanish privateer.—Major Soulange (French); Captain W. Hill (English); Captain Robert Hannah (English); and Lieut. Saint Amarand (French).

Abstract.

Total of killed	21
" wounded	18

"	drowned	4
"	not wounded	24
		67

Note.—Admiral George Martin Guise, Captain George O'Brien, Lieut. Bayley, and others killed; Admiral Thomas Lord Cochrane, Commodore (now General) Thomas Charles Wright, and others wounded; are not included in the foregoing list, because they belonged to the Patriot Navy.

APPENDIX B.

BOTANICAL DESCRIPTIONS OF THE GENUS CHINCHONA, AND OF THE SPECIES OF CHINCHONÆ NOW GROWING IN INDIA AND CEYLON.

From Weddell, Howard's Pavon, Spruce, and Karsten.

CHINCHONA.

(*From Weddell's 'Histoire Naturelle des Quinquinas,'* p. 17.)

Calyx tubo turbinato, cum ovario connato, pubescente; limbo supero, 5-dentato, persistente; dentibus in præfloratione valvatis.

Corolla hypocrateriformis, tubo tereti vel subpentagono, in angulis baseos nonnunquam fisso, intus glabro vel rarissime pilosiusculo; limbo 5-fido: laciniis lanceolatis, intus glabris, margine piloso-barbatis (pilis claviformibus lanatis) extus tuboque pubescentibus, æstivatione valvatis, explicatis patulo-recurvis.

Stamina 5, corollæ laciniis alterna, glabra; filamentis inferno tubo insertis, adnatis; antheris linearibus, inclusis vel apice subexsertis, bilocularibus, introrsis, imo dorso affixis.

Ovarium disco carnoso, pulviniformi, obsolete 5-vel 10-tuberculato coronatum.

Ovula numerosa, in placentis linearibus dissepimento utrinque affixis peltata, imbricata, anatropa.

Stylus simplex, glaber, stigma bifidum, in tubo corollino latens vel subexsertum.

Capsula ovata oblonga vel lineari-lanceolata, utrinque sulcata, limbo calycis coronata, lævis vel obscure costata, glabra pubescensve, bilocularis, polysperma, septicide a basi ad apicem dehiscens, valvulis sejunctis, pedicello simul longitrorsum fisso.

Semina plurima in placentis angulato-alatis denique liberis peltatim affixa, sursum imbricata, compressa, nucleo oblongo ala membranacea margine denticulata ex toto ambitu cincto.

Embryo in axi albuminis carnosi rectus; cotyledonibus ovatis integris; radicula tereti, infera.

Arbores vel *frutices* sempervirentes, vallium Andinarum intertropicalium inter 10° lat. Sept. et 19° lat. Austr. altitudineque 1200-3270 metr. supra Oceani ripas incolæ; trunco ramisque teretibus; ramulis sæpius subtetragonis, cicatrices foliorum stipularumque delapsorum monstrantibus, harumce vestigiis in ramis adultis etiam conspicuis.

Cortex amarus, Quinina et Chinchonina fœtus. *Peridermis* varia: modo tenuissima valde adhærens, e solo *subere* confecta; modo incrassata et stratis squamiformibus, e parenchymate cellulari librove externo constantibus formata, natura frustulatim aliquando secedens, cæterum arte haud ægre solubilis.

Lignum albidum, demum flavescens, e stratis concentricis pro arboris ætate numero variis, radiisque medullaribus secundum caulis longitudinem singulariter protractis constans; cellulæ enim quibus isti conflantur hic horizontaliter extenduntur sicutique in radiis vulgo notis lateriformes seriem plerumque triplicem agunt, illic vero præter normam longitrorsum summopere protractæ seriem simplicem exhibent; quapropter radii in trunco nudato (adempto cortice) inspecti lineas exiles hinc et illinc brevi spatio ellipticeque dilatatas effingunt. Vasa porosa approximata, seriebus continuis simplicibus ordinata.

Medulla ramorum vulgo tetragona.

Folia opposita, integerrima, decrescenti-venosa, petiolata, glabra varie pubescentia vel tomentosa, planiuscula aut margine leviter revoluta; axillis venarum venularumque paginæ inferioris in nonnullis speciebus scrobiculatis; scrobiculis simplicissimis, vacuis aut succum adstringentem sudantibus. Epidermidis cellulæ, paginæ superioris præsertim, ambitu vulgo sinuosæ, in quibusdam speciebus humore translucido tumidæ, particulas foventes innumeras innatantes, oculo armato mirantique motu rapido quasi vitali trepidantes.

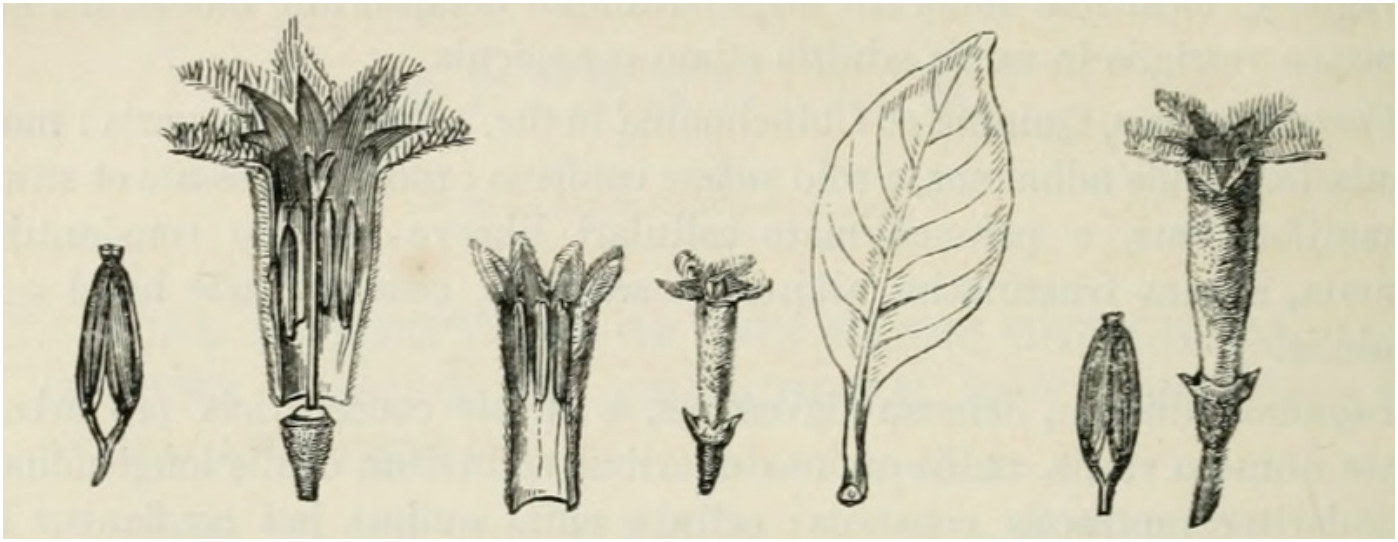
Petiolus limbo brevior, semicylindricus, subtus convexus, supra planus vel subcanaliculatus, rarissime in foliis arboris junioris teres.

Stipulæ interpetiolares plerumque liberæ citoque deciduæ vel basi leviter connatæ, intus ad basim glandulis minutis lanceolatis crebre consitæ.

Flores interdum fortuitu 4 vel 6-meri, cymoso-paniculati, albi vel sæpius carnei aut purpurascentes, mire fragrantes; paniculis terminalibus, ramulis pedicellisque basi bracteatis.

CHINCHONA CONDAMINEA.

(*From Howard's 'Nueva Quinologia of Pavon,'* No. i.)



CAPSULES AND PARTS OF THE FLOWER OF CHINCHONA CHAHUARGUERA.

(*Magnified and natural size.*)

CHINCHONA CHAHUARGUERA.

CHINCHONA CHAHUARGUERA.—Foliis oppositis, petiolatis, lanceolatis, oblongis ovato-lanceolatisque, undulatis, acuminatis acutisque, pedunculis paniculatis.

Arbor 3-4 orgyalis, comâ, frondosâ ramosissimâ.

Truncus solitarius, erectus, cortice fusco aspero maculis cinereis indutus, rimis longitudinalibus transversalibusque.

Lignum compactum, durum.

Rami erecti, teretes, cortice extus nigrescente, intus pallido cinnamomeo.

Ramuli subteretes, asperi, rimacei, colore ferrugineo-roseo.

Folia opposita, petiolata, lanceolata, oblonga ovato-lanceolataque, acuminata acutaque, utrinque glabra, subtus nervosa, venosa, integerrima, undulata, marginibus revolutis, glandulis subtus concavis rotundis villosis, ad sinus nervorum ortum insertis, supra prominentibus.

Foliola floralia opposita, petiolata, parva, ovata ovaliaque, glabra, marginibus revolutis, nervis centralibus purpureis.

Petioli teretes, purpurei.

Stipulæ duæ oppositæ, supra-axillares, sessiles, ovatæ, integerrimæ, acuminatæ, basi cohærentes, nervo centrali prominente, marginibus revolutis, deciduæ.

Pedunculi communes, terminales, axillaresque, subtetragoni, partiales pubescentes, bracteolis oppositis subulatis ad pedicellorum basim, pedicellis pubescentibus.

Pedicelli bracteolis subulatis, solitariis ad basim.

Calyx rosaceus.

Corolla dilute purpurea, extus pubescens, laciniis reflexis supra villoso-tomentosis, villis albicantibus.

Antheræ fauce parum exsertæ.

Capsula ovalis oblongaque, purpurea (nonnullæ capsulæ ventricosæ), bilocularis, bivalvis, valvulis basi dehiscentibus.

Habitat in collibus Santa Rosa nominatis, situ Huancocolla appellata, ditione Vilcobamba, Loxa provinciâ.

Floret Maio, Junio, Julio, et Augusto.

Varietas Prima, *Cascarilla amarilla fina del Rey*. Varietas Secunda? *Cascarilla colorada fina del Rey.* Varietas Tertia? *Cascarilla crespilla negra.*

(*From Howard's 'Nueva Quinologia of Pavon,'* No. vii.)

Chinchona Uritusinga.

Chinchona Uritusinga.—Foliis oppositis, petiolatis, lanceolatis; pedunculis axillaribus terminalibusque, paniculato-corymbosis, trifidis.

Arbor 20-ulnaris et ultra.

Lignum compactum, luteo colore.

Truncus solitarius, erectus, teres, crassus, fuscus, nonnullis maculis nigris obsitus, *comâ* frondosâ, valde ramosâ.

Cortex scaber, fuscus, maculis nigris fuscis et albicantibus, rimis transversalibus. *Color* intus luteus, amarissimus, acidulus, non ingratus.

Rami erecto-patentes, teretes; superiores brachiati, complanati, leviter pubescentes, dilute fusci.

Ramuli utrinque sulcati.

Folia opposita, petiolata, lanceolata, integerrima, acuta, supra glaberrima, nervosa, venosa, subtus per nervos et venas villosiuscula; nervis alternis, rarius oppositis; marginibus revolutis; *tenerrima* subtus hirsuta; *glandulis* minimis,

rotundatis, subtus concavis, circum villis albicantibus ad nervorum ortum insertis, supra prominentibus.

Petioli teretes, supra canaliculati, glabri, subtus hirsuti, basi incrassati.

Stipulæ duæ, oppositæ, interfoliaceæ, supra-axillares, ovatæ, acutæ, erectæ, integerrimæ, cauli appressæ, pubescentes, deciduæ.

Pedunculi communes axillares terminalesque, trifidi, obtusi tetragoni, paniculato-subcorymbosi, hirsuti, solitarii, erecti, complanati, foliis breviores; *partiales* hirsuti, tri-septemflori trifidique; bracteolis duabus, oppositis, minimis, ovatis, acutis, concavis, rubris, ad basim insertis, persistentibus.

Pedicelli teretes, breves, pubescentes; bracteolis solitariis, minimis, ovatis, acutis, persistentibus, ad basim et in medio insertis.

Flores nonnulli sessiles.

Calyx campanulatus, ruber, glaber, in fructu ampliatus, denticulis retroflexis persistens.

Corolla albo-rosacea, extus pubescens. *Tubus* intus glaber. *Limbus* quinque-partitus, patens; laciniis villoso-tomentosis; villis albicantibus, densis, longiusculis.

Capsula oblonga, angusta, striata, striis longitudinalibus prominentibus utrinque sulcata, lævis, calyce crescente ampliato coronata, denticulis retroflexis, bilocularis, bivalvis, basi dehiscens.

Semina minima, fulva, alâ obovatâ leviter lacerâ albo-pallescente circumdata. *Receptaculum* lineare.

Habitat prope Loxa in collibus Cajanuma, Uritusinga, Boqueron, Villonaco, Huancabamba, et Ayavaca.

Floret Maio, Junio, Julio, et Augusto.

Vulgo "Cascarilla Fina."

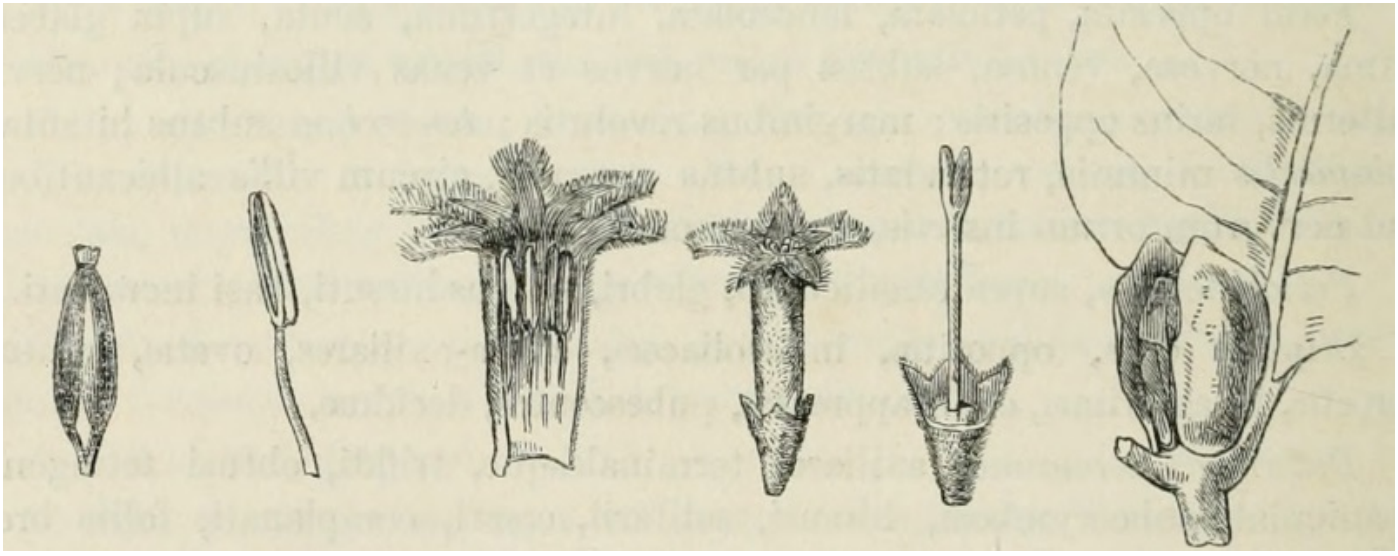
Chinchona Crispa (*Tafalla*).

(*From Howard's 'Nueva Quinologia de Pavon.'*)

Chinchona Crispa. *Quina fina de Loja*, *Cascarilla crespilla buena*, *Quina Carrasqueña*, Tafalla M.S. sec. Ruiz in M.S. Compendio, Mus. Brit.

C. Condaminea. H. et B. specimen florif. in pl. x. Pl. Equin. exclus. specim. fructif. et descriptione.

C. Chahuarguera, varietas (tertia). Pavon, Nueva Quinologia.



CAPSULE AND PARTS OF THE FLOWER OF CHINCHONA SUCCIRUBRA.

CHINCHONA SUCCIRUBRA.

(*From Howard's 'Nueva Quinologia of Pavon,' No.* iii.)

CHINCHONA SUCCIRUBRA.—Foliis oppositis, petiolatis, ovatis ovalibusque; petiolis nervisque rubicundis, glabris, nitidis; pedunculis racemoso-paniculatis.

Arbor 6-7 orgyalis.

Truncus solitarius, erectus; aliquoties duo tresve ex eadem radice repullulant. *Coma* frondosa ramosaque. *Lignum* compactum.

Cortex fuscus, nonnullis maculis albicantibus; rimis transversalibus horizontalibusque.

Rami erecti, nonnulli horizontales, teretes, *teneri* pubescentes.

Folia opposita, petiolata, ovata ovaliaque, integerrima, acumine brevissimo, nonnulla subrotunda, glabra, superne parum nitida, nervosa, venosa, venis reticulatis, nervis venisque villosis, tenuia marginibus retroflexis. *Folia superiora*, floralia petiolata, lanceolata, nonnulla sublinearia.

Petioli subteretes, basi crassiores, pubescentes, rubicundi sicuti nervi.

Stipulæ duæ, interfoliaceæ, supra-axillares, oppositæ, subamplexicaules, oblongæ, sessiles, integerrimæ, parum concavæ, cauli appressæ, deciduæ.

Pedunculi communes, axillares terminalesque, racemoso-paniculati, pubescentes. *Partiales* oppositi alternique, pubescentes.

Pedicelli bracteolis lanceolato-subulatis, parvis, concavis, deciduis, ad basim et in medio rubicundo.

Flores pedicellati, nonnulli sessiles.

Corolla rubicunda, marginibus laciniarum ciliatis, villis albicantibus.

Capsula oblonga, parum incurva, immatura rubicunda, bivalvis, basi hians. *Receptaculum* lanceolatum.

Semina alis dilaceratis.

Habitat ad radices collium, ad declivia Sancti Antonii, in via ad Huaranda Provinciæ Quitensis, locis frigidis.

Floret Julio et Augusto.

Vulgo. Cascarilla Colorada.

In arborum corticumque amputatione, succum lacteum primum profluit; postea, in colorem intense rubicundum transmutatur, unde *Cascarilla Colorada* nomen oritur.

Chinchona Succirubra (Pavon MSS.) arborea; ramis teretibus; ramulis obtuso-angulatis flavido-pubescentibus; foliis membranaceis magnis latissime ovatis petiolatis, utrinque brevissime attenuatis, supra saturate viridibus glabris subnitidis, subtus pallide viridibus puberulis, ad costam nervosque primarios pubescentibus; petiolis semiteretibus puberulis, supra canaliculatis; stipulis oblongis obtusis carinatis subpuberulis caducis; floribus congestis in paniculam terminalem interruptam dispositis; ramis floriferis pedunculatis pubescentibus erectis compressis trichotomo-ramosis, inferioribus foliosis superioribus bracteatis; bracteis subpersistentibus oblongo-linearibus, extus subpubescentibus carinatis basi attenuatis; calycibus turbinatis, basi bracteola minuta suffultis, tubo dense albido pubescente, limbo cupulari quinque-dentato rubescente sparsim pubescente, dentibus brevibus latis acutis, dorso carinatis; corollis hypocraterimorphis brevissime pubescentibus, tubo inferne attenuato, limbo quinquefido, laciniis ovatis acutis, intus longe (ad siccam) luteo-barbatis; staminibus subinclusis glabris; stylo versus basim attenuato; stigmate bipartito incluso.

(*From Spruce's Report, p. 104, described from fresh specimens.*)

CHINCHONA SUCCIRUBRA, Pavon.

Hab.—In sylvis primævis cordilleræ occidentalis Andium Quitensium præcipue ad radices montis nivosi *Chimborazo*, alt. 2000-5000 ped. Angl. (610-

1520 metr.) supra mare.

Descr.—Arbor pulcherrima, 50-80 pedalis; caudice recto circumferentiâ 4- usque ad 10-pedali; comâ symmetricâ elongatâ, ramis infimis longioribus deinde superioribus sensim decrescentibus paraboloideâ, vel ramis infimis iis proxime sequentibus sub-brevioribus ovoideâ.

Cortex, caudicis ubi lichenibus non obvelatus est fusco-badius, haud profunde longitudinaliter rimosus, demum etiam rimulis transversalibus fissus; ramulorum annotinorum rufescens, novellorum e viridi cinerascens secus apicem rubescens.

Succus ecoloratus, cortice autem inciso, in lucem aeremque susceptus exinde sæpius albescit, postea sensim albescit.

Rami decussati, angulo 50°-80° adscendentes, teretes, e foliorum stipularumque cicatricibus annulati; novelli tamen tetragoni foliosi fragiles succosi, pube brevi deciduâ densiuscule vestiti.

Folia opposita decussata, cujusque ramuli 4-6 paribus contemporalibus, cujusque paris inter se subæqualia raro valde inæqualia, sæpe perfecte ovalia, secus paniculas ovato-ovalia, raro rotundato-ovalia, basi in petiolum sensim abrupteve attenuata, apice abrupte acuta vel levissime acuminata rarius rotundata, nitida subcoriacea (fragilissima tamen) læte viridia ad luteum potius quam ad cæruleum vergentia, ætate tota sanguinea, suprà sparse decidue puberula et inter venas plus minus bullato-elevata, subtus pubescentia, raro in utraque facie glabrata; venis 11-12 cujusque lateris, angulo 56°-59° cum costâ tereti (siccando complanatâ) efformantibus, subtus prominulis, a costâ ultrà, medium rectis dein sensim incurvantibus et prope marginem anastomosantibus; petiolo tereti, e folii laminâ decurrente suprà lineis duabus parum elevatis percurso, tomentello. Folia ramulorum tenuiorum nonnunquam ovali- vel etiam obovato-lanceolata.

Stipulæ interpetiolares deciduæ erecto-patulæ ligulato-oblongæ obtusæ ad costam carinatæ, basi subventricosæ superne explanatæ, reticulato-venosæ, sub-puberulæ, juniores pallide virides, adultiores basi roseæ vel etiam totæ sanguineæ.

Pedunculi ex axillis foliorum superiorum minorum lanceolatorum (v. etiam ad bracteas lineari-lanceolatas subulatasve redactorum) orti, subinde paniculam elongatam pedalem vel etiam sesquipedalem efformantes, tomentosi, bis terve decussatum pinnati dein trichotomi; divisionibus basi bracteatis sæpe indistincte oppositis v. plane alternis. *Pedicelli* calycesque basi bracteolis minutis rigidis sanguineis ovato-lanceolatis basi utrinque unidentatis suffulti.

Calyx parvus dense appresso-puberulus; *tubus* subturbinato-hemisphæricus; *limbus* cupulatus fere ad medium usque in lobos 5 lato-triangulares carinatos, apicibus sinubusque acutis, fissus, pubescens raro subglabratus, persistens.

Corolla calycem fere 5-ies excedens, extus dense puberula, ante anthesin clavata postea hypocraterimorpha; *tubus* elongato-truncato-obconicus, intus glaber; *limbus* e lobis 5 patulis valvatis elongato-ovato-lanceolatis, margine apiceque villis densis albis (siccando flavidis) barbatis.

Stamina, corollæ tubum paululum superantia; *filamenta* glabra compressa à basi fere ad medium usque cum corollâ concreta; *antheræ* elongatæ lineares.

Stylus teres; *stigma* subemersum e lobis duobus ovato-lanceolatis crassis faciebus unisulcis erecto-patulis constans.

Capsula stricta curvulave tenui-ovoideo-fusiformis à basi dehiscens, valvulis dorso costis 5 parum elevatis percursis.

Semina anguste subovali-lanceolata sæpius asymmetrica, alâ margine lacero-fimbriatâ ciliatâ, basi angustata et ibidem integra bilobave.

CHINCHONA CALISAYA.

(*From Weddell's 'Histoire Naturelle des Quinquinas,' p. 30.*)

C. foliis oblongis vel lanceolato obovatis, obtusis, basi attenuatis, rarius utrinque acutis, glabratis, nitidis vel subtus pubescentibus, in axillis venarum scrobiculatis; filamentis quam dimidia anthera plerumque brevioribus; capsula ovata, flores longitudine vix æquante; seminibus margine crebre fimbriato-denticulatis.

α *Calisaya vera*, arbor foliis oblongo- vel lanceolato-obovatis, obtusis.

β *Calisaya Josephiana*, frutex, foliis oblongo- vel ovato-lanceolatis, acutiusculis.

α. *Calisaya Vera.*

Arbor excelsa, trunco recto vel e basi arcuatim ascendente, nudo, crassitudinem corporis humani duplam non infrequenter excedente. Coma frondosa incolas omnes sylvæ ferme superans.

Cortex trunci crassus. Peridermis ejusdem quam in omnibus fere generis speciebus crassior, e libro facile solubilis et avulsa ad hujus superficiem sulcos impressionesve sculpturas referentes detegens, rimis parallelis verticalibus et

scissuris transversalibus plus minus annularibus ornata, albida vel etiam nigricans. Ramorum peridermis dealbata aut lichenum thallis diverse marmorata, rimis magis sinuatis et scissuris angustioribus exculpta; aliis annularibus distantibus, aliis brevioribus subapproximatis. In ramulis denique cortex tenuis est, lævigatus et fusco-olivaceus vel nigricans.

Folia oblongo vel lanceolato-obovata (3 to 6 inches) 8-15 cm. long; (1 to 2 inches) 3-6 cm. lat. obtusa, basi acuta aut leviter attenuata, molliuscula, patula, supra glaberrima, nitore scilicet velutino a cellulis epidermidis prominentibus orto condecorata, obscure virentia, venis pallidioribus, parum conspicuis, subtus dilute smaragdina, glabrata, in axillis venarum scrobiculata, scrobiculis ab antica pagina vix manifestis. Petiolus 1 cm. long., virescens, rarius cum costa rubescens. In arbore juniori folia sæpius utrinque acutiuscula sunt, flaccida, læte viridia, eximie velutina, costa et petiolo roseis, nervis supra lacteo-albidis et limbo persæpe maculis roseosanguineis insignito paginaque inferiori plus minus purpurascenti.

Stipulæ oblongæ, obtusissimæ, petiolis longiores vel subæquales, glaberrimæ, basi interna glandulis parce obsitæ.

Panicula Florifera ovata vel subcorymbosa, vix multiflora, pedunculis pedicellisque (2-4 mm. long.) pubescentibus. Bracteæ lanceolatæ.

Calyx pubescens, limbo-crateriformi, dentibus brevibus, triangularibus.

Corolla 9-10 cm. long., tubo cylindrico vel basi subpentagono, et leviter angustato, in angulis interdum fisso, carneo-albescente, laciniis lanceolatis, superne roseis, villis marginalibus candidis.

Stamina in medio tubo latentia; filamenta glabra, dimidiis antheris breviora.

Stylus tubum fere æquans, stigmatis lobis linearibus, subexsertis, viridescentibus.

Panicula Fructifera laxiuscula, haud raro valde depauperata, pedunculis puberulis.

Capsula ovata (.4 to .6 of an inch) 10-15 mm. long., latitudine sua vix duplo longior, basi rotundata, ecostata, glabrata, sub maturitatem rubiginosa, dentibus coronæ brevibus, erectiusculis.

Semina elliptico-lanceolata, margine fimbriato-denticulata, denticulis approximatis, obtusiusculis; nucleo tertiam seminis partem circiter æquante.

Habitat in declivibus et præruptis montium, ad altitud. 1500-1800 m. fervidissimas inter valles Bolivæ et Peruviæ meridionalis, sylvas incolit, inter

13°-16° 30' S. lat., nempe in provinciis Bolivianis Enquisivi, Yungas, Larecaja, et Caupolican dictis, et in provincia Caravaya Peruvianorum.

Floret Aprili et Maio.

β. *C. Josephiana.*

Frutex (6½ to 12 feet) 2-3 m. alt., trunco gracili (1 to 2 inches) 3-5 cm. crass.; ramoso, ramis erectis.

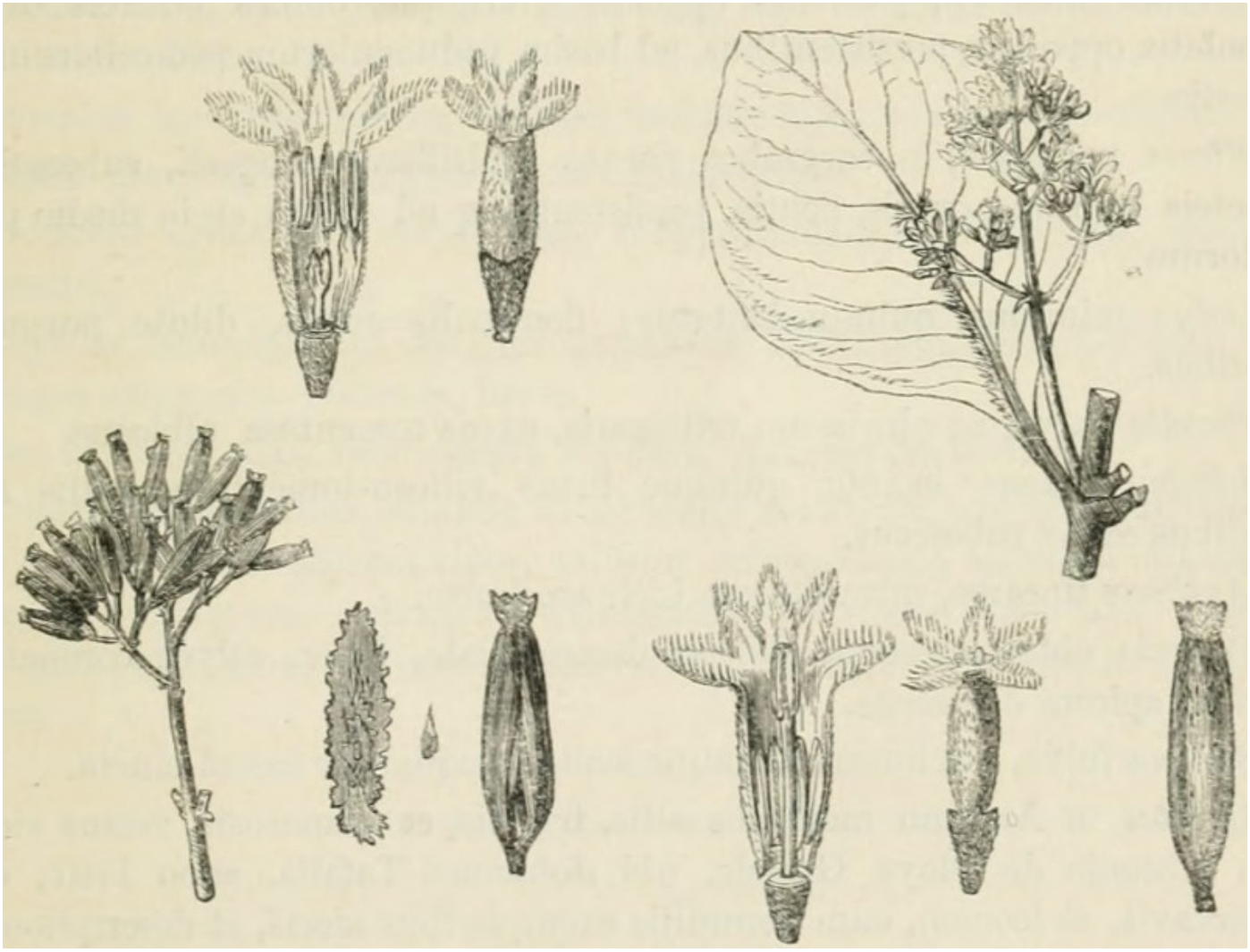
Cortex ligno valde hærens, trunci ramorumque schistaceo-nigricans, læviusculus aut lichenibus diversis ornatus scissurisque nonnullis angustissimis, distantibus, annulatim notatus; ramulorum brunneo-rufescens.

Folia oblongo- vel ovato-lanceolata, utrinque subacuta aut obtusiuscula, rigidula, superiora præsertim plus minus concava s. cymbiformia, utrinque glaberrima vel subtus pubescenti-tomentosa, læte viridia, denique sanguinea nervique et petiolus.

Panicula tum florifera cum fructifera sæpissime interrupta.

Corolla quam in varietate præcedente paulo longior. Stamina imo tubo inserta, filamentis nunc brevibus ut Calisayæ Veræ, stylo simul longiore, nunc elongatis antherisque subexsertis, stylo contra iis breviore antherisque superato.

Capsula ut in typo vel flore aliquanto longior et non raro superne plus minus attenuata, versus maturitatem pulchre rubescens simulque ramuli paniculæ. Dentes coronæ paululum elongatæ eleganterque patentes.



PARTS OF THE FLOWER AND FRUIT OF CHINCHONA MICRANTHA.

CHINCHONA MICRANTHA.

(*From Howard's 'Nueva Quinologia of Pavon,' No.* ii.)

CHINCHONA MICRANTHA.—Foliis oppositis, petiolatis, ovalibus obovatisque glabris; floribus minimis, paniculatis.

Arbor 10-15 orgyalis, comâ frondosâ.

Truncus solitarius, erectus, teres; cortice scabro-fusco-cinereo, sapore valde amaro, acidulo non ingrato; in febribus tertianis usurpari potest; in commercio ignoto.

Rami patuli, teretes, cortice fusco-nigrescente; teneri foliosi, obtuse tetragoni, glabri.

Folia opposita, petiolata, ovalia obovataque, integerrima, obtusa, acumine brevi, ampla, marginibus revolutis, patentia, ut plurimum quadripalmaria, supra

nitida, glaberrima, subtus nervosa, venosa, nervis purpureis; glandulis obovatis, subtus concavis, supra prominentibus, in foliis adolescentibus circum villosis, in senioribus deciduis, ad nervorum axillas insertis.

Petioli breves, vix pollicares, supra plano-canaliculati, subtus semiteretes.

Stipulæ supra axillares, interfoliaceæ, oppositæ, ovatæ, integerrimæ, connatæ, caducæ.

Panicula maxima diffusa, subracemosa, foliosa, floridissima, tomentosa, helvolo colore.

Pedunculi vix striati, tetragoni, compressiusculi, axillares terminalesque, *communes* brachiati, *partiales* oppositi alternique, omnes bracteis ovato-subulatis, oppositis, persistentibus, ad basim pedunculorum pedicellorumque insertis.

Flores numerosi, in corymbos parvos multifloros congesti, subsessiles; bracteis minimis, ovatis, acutis, persistentibus ad basim et in medio pedicellorum.

Calyx minimus, quinquedentatus; denticulis acutis, dilute purpurascentibus.

Corolla parva, ut plurimum trilinearis, extus tomentosa, albicans.

Limbus patens, laciniis quinque intus villoso-tomentosis, villis albicantibus extus rubescens.

Antheræ lineares, intra faucem inclusæ, luteæ.

Capsula oblonga, acuta, leviter decemstriata, fusca, calyce coronata, a basi ad apicem dehiscens.

Semina fulva, alâ lineari utrinque acutâ inæqualiter lacerâ cincta.

Habitat in Andium montibus altis, frigidis, et nemorosis, versus vicum San Antonio de Playa Grande, ubi Johannes Tafalla, anno 1797, eam observavit, et iconem, cum nonnullis exemplaribus siccis, et descriptionem, nobiscum communicavit.

Floret Maio, Junio, et Julio.

Vulgo: Cascarilla fina. Cascarilla Provinciana.

Chinchona Micrantha, β. *Oblongifolia* (Weddell).

Chinchona Micrantha, var. α. flor. extus roseis; var. β. flor. extus albidis (Poeppig).

(*From Weddell's 'Histoire Naturelle des Quinquinas,' p. 52.*)

CHINCHONA MICRANTHA.—*Arbor* 6-10 m. alt. sat frondosa, trunco recto, tereti, 2-4 dm. crassitudine raro excedente; ramis patulis.

Cortex trunci crassiusculus. *Peridermis* ejusdem tenuis, libro extus subcarioso vix hærens, plus minus lævigata, sordide grisea fuscescensve; ramorum lævis, cinerascens; ramulorum viridescens.

Folia plerumque ovato-rotundata, 12-20 cm, long. 10-15 cm. lat. basi (præcipue in junioribus) plus minus cuneata vel attenuata, obtusiuscula, membranacea, supra glabra nitidiuscula, læte viridia, subtus læevissime puberula pallide virescentia, venis venulisque parce pubescentibus, axillis pilosiusculis, pilis subfasciculatis. Petiolus 2-3 cm. long. glaber, ejusdem coloris ac costa.

Stipulæ ovatæ, obtusæ, extus pubescentes, intus puberulæ, deciduæ.

Panicula Florifera maxima, thyrsoidea; ramulis subpatentibus pedicellisque (2 mm. long.) pubescentibus, cinereo-virescentibus.

Calyx pubescens, limbo crateriformi, dentibus acuminatis.

Corolla alba, tubo tereti 5-7 mm. long. basi et fauce leviter coarctato, laciniis lanceolatis.

Stamina imo tubo inserta, antheris inclusis filamenta subæquantibus.

Stylus brevissimus; stigmatis laciniis linearibus.

Panicula Fructifera ovata vel subpyramidalis, subconferta, ramulis glabratis.

Capsula lanceolata vel oblongo-lanceolata, 25-30 mm. long. 5-7 mm. lat. utrinque attenuata, glabrata, lævis.

Semina lanceolata, basi integra vel fissa, margine denticulata.

Crescit in nemoribus humidis subobscuris montium, nec non infrequentius juxta ipsas rivulorum ripas, vallium provinciarum Larecaja et Caupolican Bolivianorum, vallisque Tambopata provinciæ Caravaya incola; provenit etiam in editioribus versus Chicoplaya et Playa Grande Peruvianorum.

CHINCHONA NITIDA.

(*From Howard's 'Nueva Quinologia of Pavon,' No.* vii.)

CHINCHONA NITIDA.—Foliis oppositis, petiolatis, obovatis, ovali-oblongis ovato-oblongisque, nitidis, paniculâ terminali—*Cascarilla Officinal*. (Ruiz Quinologia, Art. 2, p. 56.)

Arbor procera, a decem usque ad quadraginta ulnas, glabra.

Truncus solitarius, erectus, teres, aliquando tres aut quinque repullantes.

Cortex extus scaber, fusco-nigricans, sæpe ex fusco et cinereo colore variegatus; intus obscure fulvus, amarissimus, acidulus non ingratus, in commercio et in febribus tertianis magno usu fit.

Rami seniores teretes, scabri, fusco atri-cinereo colore variegati, *teneri* leviter tetragoni, fusci.

Folia opposita, petiolata, obovata, ovali-oblonga ovato-oblongaque, integerrima, nitidissima, decurrentia, marginibus ad basim revolutis, subtus venosa, venis purpurascentibus, glandulis rotundis oblongisque, supra prominentibus, subtus concavis, ad sinus nervorum ortum insertis, villis longis albicantibus vestitis.

Petioli subtus semiteretes, supra planiusculi, purpurei.

Stipulæ interfoliaceæ, oppositæ, supra-axillares, basi coadunatæ, oblongæ, sessiles, obtusæ, intus rubescentes, marginibus reflexis.

Panicula terminalis, composita, subracemosa, rubescens.

Pedunculi multiflori, tetragoni.

Flores breviter pedicellati.

Pedicelli bracteolis ovatis acumine subulato concavis ad basim stipati, persistentes.

Calyx parvus, purpureus.

Corolla alba, extus dilute rubicunda, vix semipollicaris, laciniis intus villosis, villis albicantibus.

Capsula oblonga, decem-striata, rubescens, bivalvis, valvulis basi hiantibus.

Semina ovalia, fulva, alis membranaceis oblongis inæqualiter denticulato cincta.

Habitat in Andium montibus altis, nemorosis, frigidis, ad Pampamarca, Chacahuasi, Casapi, Casapillo, Cayumba, Sapan, Cuchero, aliisque tractibus, et in montibus Provinciarum Huamalies, Tarma, et Jauja.

Floret Maio, Junio, et Julio.

Vulgo: Cascarilla fina aut Quina fina. Cascarilla lustrosa (Pritchett).

(*From Weddell's 'Histoire Naturelle des Quinquinas,' p. 47.*)

CHINCHONA NITIDA.—C. foliis lanceolato-obovatis, acutis, basi attenuatis, utrinque glabris, nitidis vel inferne leviter pilosis, escrobiculatis; filamentis antheras æquantibus; capsula anguste lanceolata, latitudine sua duplo longiori; seminibus lanceolatis, margine denticulatis.

Arbor 8-12 m. alt., trunco recto, tereti, crassitudine corporis humani; coma parum frondosa.

Cortex trunci crassus, peridermide rimosa, obscure brunnea; ramorum peridermis inæqualis, plus minus sulcato-rimosa, brunneo-cinerascens.

Folia lanceolato- vel oblongo-obovata, 9-10 cm. long., 25 mm. lat., utrinque acuta, basi cuneata aut attenuata, sub-membranacea; supra glabra nitida, subtus nonnunquam (ad venas præsertim) pilosa; petiolo 1 cm. longo.

Stipulæ oblongæ vel obovatæ, obtusæ, deciduæ, raro basi connatæ.

Panicula ovata, subcoarctata, ramulis pedicellisque puberulis; bracteis triangulari-lanceolatis.

Calyx limbo subcampanulato, dentibus triangularibus.

Corolla rosea, tubo subcylindrico, laciniis lanceolatis, villis albidis.

Antheræ apice exsertæ, filamenta æquantes vel paulo breviores.

Stylus antheras haud attingens; stigmatis lobis linearibus, brevibus.

Capsula lanceolata, denique glabra, læviuscula vel striata, sub maturitatem obscure rubiginosa, dentibus coronæ erectiusculis.

Semina lanceolata, utrinque acuta, margine denticulata.

Habitat in montibus altis, noctu frigidiusculis, diu apricis ventilatisque.

(Ruiz et Pavon. Poeppig.)

CHINCHONA PERUVIANA. (*Howard.*)

(*The "Pata de Gallinazo" of Pritchett's Collection.*)

(*From Howard's 'Nueva Quinologia of Pavon.'*)

CHINCHONA PERUVIANA.—Foliis oppositis, petiolatis, lanceolato-ovatis, basi attenuatis, junioribus lanceolatis, scrobiculatis, paniculâ terminali compositâ.

Arbor procera ... *Lignum* compactum, luteum.

Cortex extus scaber, rimosus, corticem *Calisayæ* maxime æmulans, sæpe ex albo et cinereo colore variegatis; intus obscure fulvus, amarus, fragrans.

Folia opposita, petiolata, lanceolato-ovata, nonnulla lanceolato-obovata, alia elliptica, basi attenuata, obtuse acuminata, juniora lanceolata, scrobiculata, scrobiculis supra valde prominentibus, nitida, subtus venosa.

Petioli subtus semi-teretes, supra planiusculi.

Panicula terminalis, composita, pyramidalis.

Capsula oblonga, leviter decemstriata, calyce coronata, bivalvis, valvulis basi hiantibus.

Semina ovalia, alis membranaceis, valde laceratis.

Habitat in Andium montibus frigidis Cocheros aliisque tractibus.

Vulgo: "*Cascarilla Pata de Gallinazo*."

Obs.:—In commercio magno usu fit.

Speciminibus nobis à Pritchett datis descript.

CHINCHONA LANCIFOLIA.

(*From Karsten's 'Floræ Columbiæ Specimina Selecta,'* I. p. 21.)

Arbor vasta, usque ad 24 metr. adscendens, trunco recto, 1-1½ metra in diametro; coma subovata, ramosa, ramis teretibus adscendentibus vel inferioribus, horizontalibus, cortice rugoso, fuscescenti, ut plurimum hic illic profunde transversim annulato, tectis; ramulis brachiatis, compressiusculis, uti pedicelli leviter striguloso-pilosiusculis.

Folia opposita, petiolata, petiolo semitereti 16-20 m. m. longo, supra plano, glabro, subtus pilosiusculo insidentia, lanceolata, acuminata, basi attenuata, integerrima, glaberrima, in axilla venarum leviter scrobiculata, et hic facie inferiore glomerulo pilorum obsita, patentia, læte viridia, nitida, lamina 10 centim. longa, 3½ centim. lata, petiolo nervisque, demum folio integro, rubescentibus; juniora subtus in costa minutissime pilosiuscula; vernatione applicativa.

Stipulæ interpetiolares, liberæ, lanceolatæ, acutæ, pedicellorum longitudine, glaberrimæ; intus basi pluriseriatim glandulosæ, demum rubræ, deciduæ.

Inflorescentia terminalis foliosa, paniculata, e cymis dichotomis axillaribus composita, foliis floralibus lineari-lanceolatis; pedunculi pedicellique bracteis

minutis, glabris, lanceolato-acutis, subpersistentibus, suffulti.

Calycis tubus turbinatus, ovario adnatus, pilis minutis, adpressis strigosus; limbus persistens campanulatus, quinquefidus, glaber, rubescens, laciniis triangularibus, acutis.

Corolla tubo cylindrico 10 m. m. longo, extus sericeo, carneo-rubro, intus glabro; limbo quinquepartito, lobis ovatis, acutis, æstivatione valvatis, rubris, extus sericeis, intus margine albide-villosis sub anthesin patentibus.

Stamina quinque, tubo medio inserta, paullo exserta.

Filamenta subulata, glabra, 1 m. m. longa; *antheræ* lineares, introrse longitudinaliter birimosæ, basi sagittata affixæ, filamentis paullo breviores, plus minus exsertæ; *pollen* sphæricum granulosum, triocellatum.

Discus epigynus, annularis, carnosus, subpentagonus, quinquesulcatus.

Ovarium inferum biloculare, loculis multiovulatis, placentis linearibus, medio dissepimenti longitudinaliter adnatis, ovula anatropa, pluriseriata, imbricatim adscendentia, mox peltata gerentibus; stylus teres glaber, staminibus longior, exsertus aut inclusus; stigmata duo linearia.

Capsula oblonga, striato-costata, calva, post dehiscentiam septicidam, a basi ad apicem progredientem, calycis limbo diutius coronata, epicarpio cum endocarpio connato, 17-20 m. m. longa, 6-8 m. m. lata.

Semina lanceolata, applanata, 7-8 m. m. longa, 2-3 m. m. lata, spermophoro, a valvis apertis soluto, adhærentia, caduca, ala membranacea, hyalina, imperforata, margine crenulato-denticulata, cincta; nucleo ovali sextam partem fere seminis longitudinis attingente.

Embryo in axi albuminis carnosi rectus, cotyledonibus ovalibus, planis, applicativis, radicula tereti infera.

In declivitate Andium Granatensium inter 5° et 1° lat. Sept. altitudine 2500-3000 metr. supra oceani littora ad temperaturam glacialem in horis nocturnis fere refrigerata hic illic frequenter in locis nebulosis et illuviosis nascitur.

Tunita ab incolis dicta.

APPENDIX C.

NOTES ON THE PRINCIPAL PLANTS EMPLOYED IN INDIA, ON ACCOUNT OF THEIR REAL OR SUPPOSED FEBRIFUGE VIRTUES. BY ALEXANDER SMITH, ESQ.

The following enumeration of Indian febrifuge plants, though, from the limited time at my disposal, not so complete as could be wished, will serve to give an idea of the great variety of indigenous plants used by the natives of India in the treatment of the different kinds of fevers so prevalent in that country. European physicians of the present day rely to a great extent upon the invaluable products of the *Chinchonas*, as the most certain remedies for these disorders; but a couple of centuries ago, when *quinine* and the kindred alkaloids were undreamt of, and when even Peruvian Bark, or, as it was then called, "Countess' Bark" or "Jesuits' Bark," was scarcely known, and its source a jealously guarded secret, their ancestors made use of a much greater number of substances, and highly extolled the febrifuge properties of many of our native wild plants. Most of these, however, are now known to be of little use and are discarded from the modern practice of physic, though amongst rustic practitioners, or herb-doctors, they still to a certain degree enjoy their ancient reputation. We must not therefore be surprised that the native doctors of the East, whose knowledge of chemistry and the allied sciences is as limited as was that of our old herbalists, should in like manner ascribe powerful properties to the barks, roots, stems, and other parts of plants which in reality possess as little value in a medical point of view, as the indigenous plants at one time used in our own country.

It must not, however, be imagined from these remarks that all the plants mentioned below are known to be completely devoid of medicinal properties. Some of them possibly possess qualities of the greatest value, and, were they properly tested by the enlightened science of the present day, might yield products useful either as tonics or febrifuges, or prove otherwise valuable. But the great majority are comparatively valueless, and their supposed virtues merely the result of fancy.

ALEX. SMITH.

Kew, Surrey, April 5th, 1862.

RANUNCULACEÆ.

THALICTRUM FOLIOLOSUM, *D. C.*

The bitter roots of this Himalayan species of Meadow Rue are used by the natives in intermittent fevers, and have, according to O'Shaughnessy, been experimented upon by European practitioners, and found serviceable not only as a febrifuge, but as a tonic in convalescence from acute diseases. The plant is an erect, branching perennial, three or more feet high, with large quadripinnate leaves composed of numerous small leaflets. It is common throughout the Himalayas, and is called "Pelijuree" or "Shuprak" by the natives.

COPTIS TEETA, *Wall.*

Several bitter roots are called "Teeta" in the Bengal bazaars. Those of the present plant are brought down from the Mishmee Mountains on the northern borders of Assam, and are consequently called "Mishmee Teeta." They are usually packed in little baskets about two inches wide, made of strips of rattan-cane. In the Scinde bazaars they are called "Mahmira," and they are likewise said to be imported from China under the name of "Sou-line" or "Chyn-len," but the plant is not known to be a native of that country. They have an intensely bitter taste, and the native doctors esteem them very highly as a tonic and stomachic. M. Virey says that a decoction of them is a powerful febrifuge, but O'Shaughnessy states that in experiments made in the Indian hospitals they did not seem to exercise any febrifuge virtues, though their tonic properties were very manifest. The roots of an allied American species (*Coptis trifolia*, Salisb.) are used throughout the United States and Canada as a tonic, under the name of "Gold Thread."

ACONITUM, *sp. pl.*

The roots of several species of Aconite, common in the Himalayas, are reputed to possess febrifuge properties, but the identification of the particular species is very uncertain. Amongst others the most virulent kind of "Bikh" or "Bish," that yielded by the *Aconitum ferox*, Wall., is said to be thus employed and also in chronic rheumatism; and likewise the "Bikhma" of Hamilton, supposed to be the *Aconitum palmatum*, Don. The little tuber-like roots called "Atees" or "Butees," much esteemed for their bitter tonic properties, are afforded by the *Aconitum heterophyllum*, Wall.

MAGNOLIACEÆ.

MICHELIA CHAMPACA, *Linn.*

Several of the *Magnoliaceæ* are known to possess powerful febrifuge virtues, particularly the *Magnolia glauca*, Linn., and other American species, the bark and fruits of which are greatly used in intermittent fever. Among the Indian species, the only one

reputed to possess similar virtues is the "Champa" (*Michelia Champaca*, Linn.), O'Shaughnessy remarking that, after several trials, its bark appeared to him to possess the properties attributed to the *Magnolia glauca*. It, however, contains tannin and gallic acid, both of which are absent in the American bark. The Champa grows to a large size, has ovate-lanceolate leaves from eight to ten inches long and two to four broad, and bears exceedingly fragrant yellow or orange-coloured flowers, which the Hindus offer to their deities.

BERBERIDACEÆ.

BERBERIS LYCIUM, *Royle*.

According to the learned investigations of the late Dr. Royle, it would appear that this species of Barberry afforded the λύκιον ινδικον of Dioscorides. At the present day an extract of the sliced root, stem, and branches is prepared in Nipal and the Dhoon, and employed by the native doctors in diseases of the eyes, for which purpose the drug was also valued by the physicians of old. It is known in Bengal by the name of "Rusoot" or "Rasot," and in Scinde by that of "Ruswul." Employed as a substitute for Chinchona bark this extract has been found to be a most valuable remedial agent in common and tertian agues, checking the fever in three days. The skin is invariably moist during its action. The plant is a small stiff shrub with twiggy, pale-barked branches armed with conical tripartite spines, and bearing clusters of small obovate-lanceolate leaves, either entire or with spiny teeth along the edges.

MENISPERMACEÆ.

TINOSPORA CORDIFOLIA, *Miers* (= *Cocculus cordifolius*, D. C., and *Menispermum cordifolium*, Willd.).

A tall, climbing shrub with rough corky bark, and broad, heart-shaped, pointed leaves from two to four inches long, upon stalks of about the same length; common in woods throughout the peninsula of India and in Ceylon, and known in the former country by the name of "Guluncha" or "Gurcha," and amongst the Cinghalese by that of "Rassakinda." All parts of the plant have a bitter taste, and an infusion of the young stems and leaves is highly esteemed by the native physicians as a febrifuge medicine, and also as a tonic, while in some districts it is looked upon as a certain cure for poisonous snake-bites. Ainslie says that the bruised plant is put into the water drunk by the Brahmins at some of their religious ceremonies.

TINOSPORA CRISPA, *Miers* (= *Cocculus crispus*, D. C., and *Menispermum crispum*, Linn.).

This is closely allied to the above, and is known by the same name, "Guluncha." It has smooth bark, more oval and less heart-shaped leaves on shorter stalks. Like the last it is greatly valued in the treatment of intermittent fever; but the natives in Silhet consider that it is more efficacious when found climbing upon mango-trees. It is found in Silhet and Pegu, and in several of the Indian islands.

CISSAMPELOS PAREIRA, *Linn.*

The woody stems of this widely spread tropical plant are used in a variety of diseases, and amongst others in fevers, but it is principally valued for its antilithic properties, on account of which it is admitted into our Pharmacopœias under the name of Pareira-brava. It is a tall, hard-wooded climber, indigenous to the tropics of both hemispheres, and is found in all parts of India. In Ceylon, where it is also used as a fever medicine, it is called "Deyamitta."

CAPPARIDACEÆ.

GYNANDROPSIS PENTAPHYLLA, *D. C.* (= *Cleome pentaphylla*, Linn.).

A decoction of the little black seeds of this plant is considered useful in typhus fever, and in convulsive affections. The plant is called "Vaylee" in the Tamul language; "Hurhuriya" in Bengalese; "Caraila" by the Hindus; and "Waila" by the Cinghalese. It is an annual plant, a foot or more in height, with hairy stems, and palmately divided leaves usually with five, but sometimes with seven or only three segments.

CRATÆVA NURVALA, *Ham.* (= *Cratæva Tapia*, Burm.).

A small tree, fifteen to twenty feet high, common on the banks of rivers on the Malabar coast and in Mysore, producing an astringent bark, a decoction of which is prescribed as a tonic in both intermittent and typhus fevers. The Sanscrit name of the plant is "Varuna," and it is the "Nurvala" of Rheede's Hortus Malabaricus, according to Hamilton, who says that the real name of the plant in the Malabar dialect is "Vala," the prefix "Nur" (water) merely denoting the localities in which the tree is found.

MORINGACEÆ.

MORINGA PTERYGOSPERMA, *Gaertn.* (= *Hyperanthera Moringa*, Vahl.).

Well known in India as the Horse-radish tree, on account of its roots possessing a pungent odour and biting aromatic taste similar to those of our common horse-radish, for which they are substituted by European residents in both the East and West Indies. They are also used medicinally by the native doctors as a stimulant in paralysis and intermittent fevers, and are also considered valuable as a rubefacient. "Morunghy," from

which the generic name adopted by modern botanists has been derived, is the Tamul name; and "Sujna" or "Salijuna," the Hindu. It is a small tree, seldom more than twenty feet high, and has large compound three-times pinnated leaves, and axillary bunches of whitish flowers, producing long pendulous three-sided fruits, containing numerous winged seeds, which some authors regard as the source of the celebrated Ben-oil.

CARYOPHYLLACEÆ.

MOLLUGO CERVIANA, *Ser.* (= *Pharnaceum Cervianum*, Linn.).

This little herb is used as a medicine in fevers in Ceylon, where it is called "Pat-paadagan;" and as the plant is also found in the Indian peninsula, it is most probably employed in a similar manner by the Hindu doctors. The order to which it belongs is remarkable for little besides the presence of *saponine* in several species.

MALVACEÆ.

SIDA ACUTA, *Burm.* (= *Sida lanceolata*, Retz.).

The roots of this have an intensely bitter taste, and their infusion, in conjunction with ginger, is prescribed in cases of intermittent fever, for which they have also been tried in the Indian hospitals, but without satisfactory results, though they were found to possess some medicinal virtues as a tonic. The plant is called "Pata" in Sanscrit; and "Malaytanghie" in Tamul. It is a shrub with narrow lance-shaped, pointed leaves, coarsely toothed along the edges, and either smooth or sprinkled with bristly hairs, especially on the veins underneath.

PAVONIA ZEYLANICA, *Cav.* (= *Hibiscus Zeylanicus*, Linn.).

A tall annual plant, with variable leaves, the lower ones being roundish heart-shaped, and the upper deeply three to five lobed, and whitish or pale-red flowers. It is called "Sittamootie" in Tamul, and an infusion of the root is administered in fevers, but Ainslie states that it does not appear to possess any virtues.

OLACACEÆ.

OLAX ZEYLANICA, *Linn.*

A small tree, native of Ceylon and of some parts of India, yielding a fœtid, salt-tasted wood, which is employed in putrid fevers. The Cinghalese, who call the tree "Malla," eat the leaves in their curries.

AURANTIACEÆ.

ÆGLE MARMELOS, *Corr.* (= *Cratæva Marmelos*, Linn.).

The Bengal Quince-tree. Almost every part of this tree is used medicinally by the native Indian doctors. In fever cases a decoction of the bark of the root, and also of the stem, is employed, but when the latter is used it is generally combined with a great variety of other substances. The expressed juice of the leaves, diluted with water, is also administered in incipient fevers and colds. The fruit is a valuable remedy in diarrhœa and dysentery, and has been successfully employed in those complaints by medical men in this country. It is a tree of moderate size, with its young branches furnished with sharp spines, and has ternate or rarely pinnate leaves, and axillary panicles of few large fragrant flowers. It has a great number of vernacular names. In Hindustanee and Bengalee it is called "Bael, Bêl, or Bêla;" in Telinga, "Maredoo;" in Tamul, "Willamarvum;" in Malayan, "Tanghula," &c.

MELIACEÆ.

AZADIRACHTA INDICA, *A. de Juss.* (= *Melia Azadirachta*, Linn.).

The bitter astringent bark of this tree, the Neem or Margosa tree of India, is considered by the native doctors to be a most valuable tonic and febrifuge, and it has been successfully employed as a substitute for Chinchona-bark by English physicians in India. A bitter principle called *Azadirine* has been obtained from it. Other parts of the tree are likewise reputed to possess medicinal properties: the bitter oil obtained from the pericarp being employed as an anthelmintic, and the olive-like fruit itself in leprosy, while the leaves are universally used in India for poultices. The Neem forms a large ornamental tree, and has pinnate leaves with unequal-sided smooth leaflets sharply toothed at the edges, and loose axillary panicles of bluish flowers. "Neem" or "Nim" is its Hindustanee and Bengalee name; "Nimba," in Sanscrit; "Vaypun" or "Vapan," in Tamul; and "Kohomba," in Cinghalese.

CEDRELACEÆ.

CEDRELA TOONA, *Roxb.*

The Toon-tree grows to a large size, and yields a valuable reddish timber, resembling some kinds of mahogany. It has abruptly pinnate leaves composed of from six to twelve pairs of opposite, usually entire, smooth leaflets of an ovate-lanceolate shape; and its flowers are small, yellowish, and sweet-scented, and are disposed in terminal drooping panicles. Toon bark is powerfully astringent, but is said to be devoid of bitterness. It is much esteemed in the treatment of intermittent fever, though seldom administered alone,

but generally prescribed in combination with the excessively bitter seed of the *Guilandina Bonducella*. The flowers yield a yellow dye, but the colour is not permanent.

SOYMIDA FEBRIFUGA, *A. de Juss.* (= *Swietenia febrifuga*, Roxb.).

The specific name of this tree indicates its use as a medicine in fevers. The part employed is the bark, which is of a reddish colour and has a very bitter, slightly astringent, but not unpleasant taste. It was long ago highly recommended as a substitute for Peruvian bark by several English doctors in India, and appears to possess considerable medicinal virtues, though Ainslie found that when given in large doses it deranged the nervous system, occasioned vertigo and subsequent stupor. The tree is called "Shemmarum" by the Tamuls; "Soimido" by the Telingas (whence the generic name adopted by botanists); and "Rohuna" by the Bengalese. It is a very large, hard-wooded tree, with abruptly pinnate leaves composed of from three to six pairs of opposite, oval-oblong blunt leaflets; and produces large panicles of small yellowish flowers towards the points of the young branches.

The bark of another large Indian tree belonging to this order, the "Chikrassee" of the Bengalese (*Chickrassia tabularis*, A. de Juss.), is a powerful astringent, but, like the Toon bark, devoid of bitterness.

OXALIDACEÆ.

AVERRHOA BILIMBI, *Linn.*

A syrup prepared with the juice of the excessively acid gherkin-like fruits of the Bilimbi is used by the native doctors in the treatment of fevers, as also is a conserve of the flowers. The Bilimbi is a small tree, with unequally pinnate leaves, which, like those of the well-known sensitive plant, are irritable and close their leaflets together when touched. Its fruits are commonly used for pickling by Europeans, both in the East and in the West Indies.

XANTHOXYLACEÆ.

TODDALIA ACULEATA, *Pers.* (= *Scopolia aculeata*, Smith).

Powerful stimulating properties are ascribed to all parts of this plant. The fresh bark of its root is administered by the Telinga physicians, who call the plant "Conda cashinda," for the cure of the kind of remittent fever known by the name of "hill fever," from its being caught in the jungles of the Indian hills. It is a moderately tall shrub with prickly stems and branches, alternate, trifoliate, smooth leaves marked with numberless pellucid dots, and usually having prickles on their stalks and on the midribs of the

leaflets; and its flowers, which are whitish and strong scented, are borne in simple or compound racemes. Its Cinghalese name is "Koodoomirris-wel."

SIMARUBACEÆ.

SAMADERA INDICA, *Gaertn.*

All parts of this tree partake of the excessively bitter qualities common to the order. The decoction of the rasped wood has recently been extensively and successfully employed in Ceylon, in the treatment of intermittent fever, and is recommended to be given in combination with Myrobalan galls. The wood is of a pale colour, resembling quassia-wood, and is very light. The tree is indigenous to Ceylon, and also to the Indian peninsula, and is the "Karin-njotti" of Rheede. It attains a considerable size, and has oblong-elliptical, alternate leaves, and long, pendulous, compressed flower-stalks, divided at the top into a many-flowered umbel. The bark, called "Niepa bark," also possesses febrifugal properties.

RHAMNACEÆ.

ZIZYPHUS JUJUBA, *Lam.* (= *Rhamnus Jujuba*, Linn.)

The root of this common Indian tree is a reputed febrifuge, and an infusion of it, combined with some warm seed, is said to be employed as such in the Moluccas, while the bark is used in diarrhœa. It is a small tree, with prickly branches, usually having the spines in pairs, and elliptical or oblong obtuse leaves, covered on the under side, as also are the branches, with dense short tawny tomentum, and it bears small greenish-yellow flowers, which produce roundish, yellow, edible fruits about the size of cherries. Its Sanscrit name is "Vadari," and its Bengalese "Kool."

LEGUMINOSÆ.

CASSIA FISTULA, *Linn.* (= *Cathartocarpus Fistula*, Pers.).

The black, sweet-tasted pulp contained in the long cylindrical pipe-like pods of this common tropical plant is well known as a gentle laxative medicine; and its roots are reputed to be an excellent febrifuge. It is the "Sonali" of the Bengalese, the "Amultas" of the Hindus, and the "Ahalla" of the Cinghalese, and is a moderately large tree, with very long pinnate leaves, and loose drooping racemes of bright-yellow fragrant flowers.

GUILANDINA BONDUCELLA, *Linn.* (= *Cæsalpinia Bonducella*, Fleming).

The seeds and bark, but particularly the former, have an intensely bitter taste, and are supposed to possess powerful tonic virtues. The seeds, called Bonduc nuts, are lead or ash coloured and most excessively hard. Their cotyledons, powdered and combined with spices or other medicinal substances, are prescribed with beneficial results in intermittent fever. The root is also said to be a good tonic in dyspeptic complaints; in fact, all parts of the plant are reputed to possess medicinal properties. The plant is a prickly, trailing shrub, with abruptly twice-pinnate leaves, each pinna consisting of from five to eight pairs of oval leaflets, and bears racemes of rusty-yellow flowers. The Tamuls call it "Kalichikai;" the Telingas "Getsakaia;" the Hindus "Cat-caleyi" and "Natacaranja;" and the Cinghalese "Koombooroo-wel." It is a common plant throughout the tropics of both hemispheres.

PHASEOLUS TRILOBUS, *Roth.* (= *Dolichos trilobus*, Linn.).

Ainslie says that "this plant was brought to Dr. F. Hamilton in Bahar, where he was informed by the Vytians of that district that the fresh herb was given in decoction in cases of irregular fever." It is a procumbent, spreading, herbaceous plant, with leaves composed of three roundish, entire, or three-lobed leaflets on long stalks, and bears a few pea-like flowers at the ends of long ascending stalks.

ORMOCARPUM SENNOIDES, *D. C.* (= *Hedysarum sennoides*, Willd.).

A shrub with glutinous hairy shoots, unequally pinnate leaves, and short axillary racemes bearing a few pea-like flowers, producing jointed pods. The decoction of the roots of this shrub, which is called "Caat Morungie" in the Tamul language, and "Adivie moonaga" in Telinga, is prescribed by the native physicians as a tonic and stimulant in fevers, and a liniment made of the powdered bark and sesamum oil is applied externally in paralysis and lumbago.

COMBRETACEÆ.

TERMINALIA TOMENTOSA, *W. et A.* (= *Terminalia alata*, Roth.).

This is a large tree with deeply-cracked bark, and nearly opposite, linear, oblong, obtuse leaves, somewhat cordate at the base, crenulate, and clothed with pubescence underneath. It is the "Peea-sal" or "Usan" of the Bengalese; the "Nella madoo" of the Telingas; and the "Aans" of the Hindus. The reddish-brown, cracked bark has a strong but not unpleasant astringent taste, and is classed amongst the febrifuge medicines by the native doctors: powdered and mixed with oil it is employed in apthæ.

MYRTACEÆ.

SYZYGIUM CARYOPHYLLIFOLIUM, *D. C.* (= *Calyptranthes caryophyllifolia*, Willd.).

"Nawel" of the Tamuls; "Nereddie" of the Telingas; and "Madang" of the Cinghalese. The thick, brownish-coloured bark of this tree has an astringent, slightly aromatic taste, and a decoction of it is sometimes prescribed by native doctors in fevers and bowel complaints, and is also employed as a wash for foul ulcers. It has been recommended as a tanning substance, but it does not possess sufficient astringency to render it suitable for that purpose. The tree has smooth, entire leaves of an oblong-lanceolate shape and attenuated at the base, and bears cymose panicles of flowers upon the old branches, producing little edible fruits about the size of peas.

BARRINGTONIACEÆ.

BARRINGTONIA RACEMOSA, *Roxb.* (= *Eugenia racemosa*, Linn.).

"Cadapum" (Tam.); "Kamtee" (Tel.); and "Deya-midella" (Cing.). Ainslie says that the reddish-coloured bark of the Cadapum is supposed to possess virtues similar to those of Chinchona bark. Medicinal properties are also ascribed to the root and seed, both of which have a bitter though not unpleasant taste. It is a large tree, with cuneate-oblong, acuminate, serrulate leaves, crowded together towards the ends of the branches, and long pendulous racemes of large flowers, producing ovate, bluntly quadrangular fruits.

CUCURBITACEÆ.

ZANONIA INDICA, *Linn.*

Mr. Thwaites says that the Cinghalese value this plant as a febrifuge, and call it "Walrasakinda." It is also found in India, and is the "Penar-valli" of Rheede's Hortus Malabaricus. The plant is a climber, supporting itself by means of tendrils, and has alternate, elliptical, pointed leaves, slightly cordate at the base, and axillary racemes of flowers.

TRICHOSANTHES CUCUMERINA, *Linn.*

This is another cucurbitaceous plant much used by the Cinghalese as a febrifuge, and from the experiments made with it in the hospitals at Badulla it appears to possess considerable efficacy. It is astringent and contains a bitter principle, which it yields to boiling water, and is therefore recommended to be used in the form of an infusion, made with the dried stem and leaves. The plant is called "Doommaala" by the Cinghalese, and is very common both in Ceylon and India. It is an annual climbing plant, with three-cleft tendrils, and broadly-cordate, angular or lobed leaves toothed along the edges. Its seeds are used in bowel complaints.

UMBELLIFERÆ.

HYDROCOTYLE ASIATICA, *Linn.*

The Asiatic Pennywort has recently been discovered to be a valuable remedy in leprosy, scrofula, venereal, and other complaints. The native doctors, however, have hitherto considered it serviceable only in bowel complaints and fevers, administering it in the form of an infusion of the toasted leaves in combination with fenugreek. It has a bitter, pungent, disagreeable taste, and when bruised gives off a peculiar offensive odour. The active principle of the plant is said to be due to a thick pale-yellow oil or extract, which has been called *Vellarine*, from the Tamul name of the plant, "Vullarei." Its Telinga name is "Babassa;" its Hindu, "Thulkura;" and its Cinghalese, "Heen-gotookola." By the latter people it is used as an anthelmintic. Though named *Asiatica* by botanists, it is by no means confined to that continent, but is spread very generally throughout the tropics. It has creeping stems, and tufts of roundish kidney-shaped leaves.

CHINCHONACEÆ.

HYMENODYCTION EXCELSUM, *Wall.* (= *Cinchona excelsa*, Roxb.)

Roxburgh supposed this tree to belong to the same genus as the Peruvian barks, but no species of true *Chinchona* has ever been found wild in the Eastern hemisphere. The present tree grows to a large size and yields a thick bark, the inner coatings of which possess the bitterness and astringency of the real Peruvian bark, especially when fresh; but the bitterness, though more durable, is not so quickly communicated to the taste. It is called "Bundaroo" by the Telingas.

COMPOSITÆ.

VERBESINA CINEREA, *Less.* (= *Conyza cinerea*, Linn.).

A low-growing annual plant, widely spread throughout the tropics of the old world, and considered by the Hindus to possess medicinal virtues, a decoction of the entire herb being administered in febrile affections in order to promote perspiration. It is the "Seera shengalaneer" of the Tamuls, and the "Gherutti Kamma" of the Telingas.

AUCKLANDIA COSTUS, *Falc.*

In an elaborate memoir upon this plant, Dr. Falconer has shown it to be the source of the celebrated "Costus" of the ancients, which was previously referred to the *Costus Arabicus*, Linn. (= *Costus speciosus*, Sm.), a plant belonging to the order *Zingiberaceæ*. It is a gregarious herbaceous plant with a perennial root sending up annual erect stems six or seven feet high, bearing large, somewhat lyrate pinnatifid

leaves. Costus-root is collected in large quantities in Cashmere, but the only use made of it there is for perfuming bales of shawls, and thus protecting them from insects, the great bulk of it being exported to China and Persia, in both of which countries it is highly esteemed as a medicine, the Persian doctors regarding it as an efficacious remedy in nearly all the ills human nature is heir to. Ainslie says that the native practitioners in India prescribe an infusion of it as a stomachic and tonic, and also in the advanced stages of typhus fever. In Cashmere it is called "Koot," which agrees with the Arabic "Koost:" in Bengal it is known by the name of "Putchuk."

EMILIA SONCHIFOLIA, *D. C.* (= *Cacalia sonchifolia*, Linn.).

"Shudimudi" of the Bengalese, or "Kadoo-para" of the Cinghalese. An annual, with erect or spreading, branching stems, and variously shaped leaves, the lower ones being usually lyrate, and the upper more or less amplexicaul, with blunt or sharp auricles. On the Malabar coast the native practitioners, according to Rheede, consider a decoction of this plant to possess antifebrile qualities.

EBENACEÆ.

DIOSPYROS EMBRYOPTERIS, *Pers.* (= *Embryopteris glutinifera*, Roxb.).

An American species of *Diospyros* (*D. Virginiana*, Linn.) is employed as a febrifuge by rustic practitioners in the United States, and O'Shaughnessy states that the bark of the present tree has been given in India, but with doubtful results, in the treatment of intermittent fevers. It is well known as the Gaub-tree, and the viscid, excessively astringent juice of its fruit is used for tanning, and for paying the seams of boats. It is a middle-sized tree, with long elliptic-lanceolate, smooth, coriaceous leaves, and whitish flowers.

APOCYNACEÆ.

OPHIOXYLON SERPENTINUM, *Willd.*

"Chivan amelpodi" in Tamul; "Chota Chand" in Hindostanee; "Chandra" in Bengalee; "Patalganni" in Telinga; and "Aikawaireya" in Cinghalese. The root of the Chandra is very bitter, and is administered by the Telinga and also by the Javanese doctors in the form of a decoction, as a remedy in fever cases. It is one of the numberless supposed remedies for the bites of venomous snakes, but, as in many other similar instances, its virtues are fanciful, and its great reputation is probably ascribable to the old doctrine of *signatures*, the plant being a climber and having a twining stem.

WRIGHTIA ANTIDYSENTERICA, *R. Br.* (= *Nerium antidysentericum*, Linn.).

The bark of this species of *Wrightia* is included in some European works on Materia Medica under the name of Tellicherry or Conessi bark. It has long enjoyed a high reputation in India as a tonic and febrifuge; but other parts of the plant likewise appear to possess similar properties, a decoction of the long oat-like seeds being employed in ardent fever. The bark is also given in dysentery. Among the Tamuls it goes by the name of "Veppalei," while the Hindus call it "Curayia," and the Telingas "Pala codija." It is a small tree producing a white ivory-like wood, which has been tried for engraving purposes, but found unsuitable on account of it not being of even quality throughout. It has obovate-oblong, shortly acuminate, smooth leaves, and nearly terminal corymbs of jasmine-like flowers.

ASCLEPIADACEÆ.

CALOTROPIS GIGANTEA, *R. Br.* (= *Asclepias gigantea*, Linn.).

Various parts of the Yercum-plant have long been employed for medicinal purposes by the native doctors, and experiments made by Anglo-Indian practitioners have proved that the inner bark of the root, called Mudar bark, is a valuable remedy in leprosy, and that it may also be given with advantage in several other complaints, including intermittent and other fevers. An elastic gum and a valuable fibre are also obtained from the plant. There are two varieties of Yercum, one with white and the other with purple flowers, the former forming a tree fifteen or twenty feet high, and the latter a shrub.

LOGANIACEÆ.

STRYCHNOS NUX-VOMICA, *Linn.*

According to Roxburgh the exceedingly bitter wood of the Nux Vomica is employed as a remedy in fevers of the intermittent kind, and also for the cure of snake-bites, when that of the next species cannot be obtained. The poisonous bark is commonly sold in the Indian bazaars in place of the febrifuge "Rohuna bark," which is in reality the produce of *Soymida febrifuga*. It is the false Angostura bark of our Materia Medica. Nux Vomica seeds have also been administered with some benefit in intermittent fever. The *Strychnos Nux-Vomica* forms a small tree, has oval, entire, shining leaves, strongly marked with from three to five longitudinal nerves, and bears small corymbs of greenish-white flowers.

STRYCHNOS COLUBRINA, *Linn.*

The "Naga musadi" of the Telingas, or "Koochilaluta" of the Bengalese. The wood of this species is greatly esteemed by the natives as a remedy for snake-bites, and is also given in cases of intermittent fever. It is a climbing shrub with thick woody tendrils,

elliptic-oblong, blunt-pointed, three-nerved leaves, and small corymbs of yellowish flowers.

GENTIANACEÆ.

OPHELIA CHIRATA, *Griseb.* (= *Gentiana Chirayta*, Roxb., and *Agathotes Chirayta*, Don.).

The name "Chirata" or "Chirayta," by which this plant is commonly known in India, is derived from the Sanscrit "Kiratatica." The dried stems of the Chirata have long been famed amongst the natives of India as a tonic and febrifuge; and they have also gained considerable reputation amongst European practitioners in India, who, however, have found them to be more efficacious in the cure of intermittent fever when employed in combination with the seeds of the *Guilandina Bonducella*, mentioned above. It is an annual plant, two or three feet high, with smooth round stems and opposite, ovate or somewhat cordate, acuminate leaves, marked with from five to seven nerves, and bears yellow flowers. Chirata is included in the Edinburgh Pharmacopœia.

OPHELIA ANGUSTIFOLIA, *Don.* (= *Swertia angustifolia*, Ham.).

The stems of this species are called "Pukaree Chirata" in the Himalayas, and are substituted for the true Chirata. The species is distinguished by its stems being somewhat four-sided, by its much narrower, sharper-pointed, obscurely three-nerved, short-stalked leaves, and by its white, violet-spotted flowers. Both this and the true Chirata are natives of the Himalayas.

OPHELIA ELEGANS, *Wight.*

It has recently been discovered that the stems of this South Indian species are made up into bundles in the same manner as the Himalayan Chiratas, with which they have hitherto been confounded in the bazaars. The plant, however, has a different native name, being called "Salaras" or "Salajit" by the inhabitants of the Pulney hills; but it is considered equally efficacious as a febrifuge. It has obsoletely four-sided stems, narrow, ovate-lanceolate, sessile, three-nerved leaves, tapering to a slender point, and beautiful pale-blue flowers.

SALVADORACEÆ.

SALVADORA, *sp.*

A decoction of the bark of a species of *Salvadora* is recommended by Hindu doctors in cases of low fever, and as a tonic. Great confusion, however, exists among the species of this genus, and it is therefore uncertain which one is thus employed. Ainslie mentions

Salvadora Persica, but it is very doubtful whether that species is found in any part of India.

CORDIACEÆ.

CORDIA MYXA, *Linn.*

Tonic and febrifuge properties are ascribed to the bark of this tree, it being, according to Horsfield, one of the chief remedies used in fevers by the Javanese, who call it "Kendal." It is a small tree with rounded branches, ovate leaves, smooth on the upper surface but roughish underneath, and usually terminal panicles of flowers, producing yellow, sweet-tasted pulpy fruits about the size of cherries. In the Tamul language it is called "Vidi marum;" "Nekra" in Telinga; "Lesura" in Hindostanee; and "Loloo" in Cinghalese.

SOLANACEÆ.

SOLANUM XANTHOCARPUM, *Schrad. et Wendl.* (= *Solanum Jacquini*, Willd.).

There are two varieties of this plant, one of which was formerly considered a distinct species, and named *Solanum Jacquini*. All parts of the latter variety are used medicinally, and it is one of the fever remedies employed by the Cinghalese, who call it "Kattoo-wel-battoo." It is a decumbent, spreading annual plant, armed with numerous long white prickles, and has sinuately-pinnatifid prickly leaves. The Tamuls call it "Kandung Kattiri."

SCROPHULARIACEÆ.

PICRORHIZA KURROOA, *Royle.*

A small perennial herbaceous plant found in Kemaon, at Gossain-than, and other parts of the Himalayan mountains, where its roots, which are called "Hooling" in Tibet, and have a powerful bitter taste, are used as a febrifuge by the natives, and also sent down to the bazaars of Bengal, where they form one of the many bitter roots sold under the name of "Teeta." The plant grows about six inches high, and has scarcely any stem, its leaves all rising from the summit of the thick root, and also its flower-stalks, which are five or six inches high, and bear a dense spike of small bluish flowers at the top.

HERPESTIS MONNIERIA, *Humb.* (= *Gratiola Monnieria*, Linn.)

The Cinghalese consider this plant to possess febrifuge virtues: they call it "Loonoo Weela." In India its expressed juice is mixed with petroleum, and used as a topical

application in rheumatism. It is a little creeping plant, common in moist places throughout the tropics of both hemispheres, and has obovate-cuneate leaves, bearing solitary long-stalked pale-blue flowers in their axils. The Bengalese call it "Adha birni," and the Telingas "Sambrani-chittoo."

ACANTHACEÆ.

ANDROGRAPHIS PANICULATA, *Nees ab Essen.* (= *Justicia paniculata*, Burm.).

This is the celebrated Creyat, the principal ingredient in the famous bitter tincture called *drogue amère*, so highly esteemed in India for its tonic and stomachic properties, and also as a febrifuge. The entire plant is employed, the intensely bitter principle being found in all parts of it. It is an annual, with stiff quadrangular stems from one to two feet high, bearing smooth lanceolate leaves, attenuated at the base. In the Telinga language it is called "Nella vemoo;" in Bengalese, "Kala-megh;" in Hindustanee, "Calapnath;" and in Tamul, "Kiriat," hence the common Indian name of the plant, Creat or Creyat.

JUSTICIA ADHATODA, *Linn.* (= *Adhatoda Vasica*, Nees ab Essen.)

The flowers, leaves, and roots have a bitterish and somewhat aromatic taste, and are supposed to possess antispasmodic properties. An infusion of them, especially of the flowers, is given to prevent the return of rigour in intermittent fever. In Ceylon it is used as an expectorant for children. The Bengalese call the plant "Bakus;" the Tamuls, "Adhatodey;" the Cinghalese, "Paawetta;" the Telingas, "Adasara;" and in Sanscrit it is called "Vasica" or "Uroos." It forms a tree fifteen or twenty feet high, with elliptic oblong leaves, attenuated to both ends, and pale-coloured flowers with purple stripes and rusty spots.

LABIATÆ.

OCIMUM SANCTUM, *Linn.*

The Tamul physicians prescribe a decoction of the root of this common Indian species of Basil in fever cases, and the juice of the leaves in catarrhal affections. The Brahmins consider the plant sacred to Vishnu, and cultivate it in the vicinity of temples, while the Malays strew it upon the graves of their departed friends. The whole plant generally has a purplish tinge, and grows about a foot high: it has long-stalked, downy, oval leaves, toothed along the edges, and small pale-purple flowers. Its Tamul name is "Toolasee;" its Bengalese, "Kala-toolsee;" and its Cinghalese "Madooroo-tallu."

ANISOMELES MALABARICA, *R. Br.* (= *Nepeta Malabarica*, Linn.).

"Pemayrutie" of the Tamuls; "Moga beerakoo" of the Telingas; and "Bootan Kooshum" in Sanscrit. A shrub, 2 to 5 feet high, clothed with short tomentum, and having oblong-lanceolate leaves, narrowed at the base, and purplish flowers disposed in distant whorls. The leaves are bitter, astringent, and somewhat aromatic, and are given in infusion in the later stages of dysentery and in intermittent fevers. Patients suffering under the last-mentioned disease are also made to inhale the vapour rising from an infusion of the whole plant, in order to induce a copious perspiration.

GENIOSPORUM PROSTRATUM, *Benth.* (= *Ocimum prostratum*, Linn.).

A small herb used as a febrifuge by the natives of the Madras presidency. It has a prostrate stem and numerous hispid branches, bearing small oblong-lanceolate, serrated leaves, and long spike-like racemes of very small flowers.

ROYLEA ELEGANS, *Wall.* (= *Phlomis calycina*, Roxb., and *Ballota cinerea*, Don.).

According to the late Dr. Royle, after whom the genus is named, this plant is employed as a febrifuge in the Himalayas, where it is called "Putkuroo." It is a much-branched, erect shrub from three to five feet high, having the branches clothed with ash-coloured tomentum, and bearing ovate, sharp-pointed, coarsely toothed leaves, slightly cordate at the base. Its flowers vary from white to pale-rose colour.

VERBENACEÆ.

PREMNA SERRATIFOLIA, *Linn.* (= *Premna integrifolia*, Linn.).

The warm, bitterish-tasted root of this plant is prescribed in decoction by the native practitioners as a gentle stomachic and cordial in fevers. It has an agreeable odour. The tree is called "Moonnee" by the Tamuls; "Ghebboonellie" by the Telingas; and "Middee-gass" by the Cinghalese. Its trunk and large branches are armed with spines, and its leaves are ovate or oval, entire or toothed towards the top, of a shining green above and paler underneath.

VITEX TRIFOLIA, *Linn.*

Different parts of this plant are employed medicinally, in various ways and for various diseases, by native doctors in India and also in Java. The part used as a remedy for intermittent fever is the leaves, which are powdered and taken in water. Pillows stuffed with them are used to cure cold in the head, and headache. It is a decumbent shrub, with the branches, under side of the leaves, and inflorescence mealy-white. There are two varieties: one with trifoliate and the other with simple leaves. Its Tamul name is "Neer-noochie;" its Telinga, "Neela vavilie;" and its Hindustanee, "Nisindha," or "Seduari."

VITEX NEGUNDO, *Linn.*

This species is considered to have medicinal properties similar to but weaker than the last. The decoction of the root has a pleasant bitter taste, and is administered in cases of intermittent and typhus fever. In Tamul it is called "Noochie;" in Telinga, "Wayalakoo;" in Hindustanee, "Nisunda;" and in Cinghalese, "Sooddoo-nikka." It is a more erect shrub than the last, and its leaves are all compound, consisting of from three to five entire or toothed or deeply pinnatifid leaflets, covered with white meal underneath, as also are the branches and flowers.

NYCTAGINACEÆ.

BOERHAAVIA DIFFUSA, *Linn.* (= *Boerhaavia procumbens*, Roxb.).

The roots of several species of *Boerhaavia* are employed medicinally by the natives of various parts of the world. In India those of the present have the reputation of being antifebrile, and Ainslie also says that the native practitioners include them amongst their laxative medicines. This plant is a herbaceous perennial with decumbent, smooth, or rarely pubescent stems and leaves, the latter varying very much in shape. Among the Bengalese it is known by the name of "Gadha-poorna;" and it is the "Pittasooddopala" of the Cinghalese. Its leaves are eaten as a potherb.

EUPHORBIACEÆ.

TRAGIA CANNABINA, *Willd.*

"Sirroo canchorie" in the Tamul; and "Doolya-gunda" in the Telinga language. The root of this plant has a pleasant odour when fresh: the native doctors consider it to possess diaphoretic and alterative qualities, and they prescribe an infusion of it in ardent fever. It is an erect shrub, about four feet high, with hispid stems and leaves, the latter being divided into three sinuated lobes. Roxburgh says that the hairs on this plant sting as bad as those of the common nettle.

PIPERACEÆ.

CHAVICA BETLE, *Miq.* (= *Piper Betle*, Linn.).

This affords the celebrated Betle leaves, so extensively employed as a masticatory in the East. Ainslie says that the warm juice of the leaves is prescribed by the native doctors as a febrifuge, in the quantity of a small spoonful twice daily.

PIPER NIGRUM, *Linn.*

Black pepper has long been known to possess febrifuge powers: an infusion of it in some kind of spirit is a popular remedy for preventing the return of the paroxysms in intermittent fevers. The root, however, is the part used by the native doctors in India, and is administered in the form of a decoction. *Piperin*, one of the constituents of pepper, has been said to be a more certain and speedy febrifuge than the chinchona alkaloids, but O'Shaughnessy says that after repeated and careful trials he found it was not of the least utility. The Tamul name of the plant is "Shuvium."

ZINGIBERACEÆ.

CURCUMA LONGA, *Linn.*

The uses of the various kinds of Turmeric for dyeing purposes and as a condiment, particularly for the preparation of curry-powder, are well known, both in this country and to the natives of India; but the latter consider that it also possesses medicinal virtues, and give it as a stimulant and tonic in intermittent fever and some other diseases. European practitioners at one time regarded it as useful in jaundice.

LILIACEÆ.

ALLIUM SATIVUM, *Linn.*

Ainslie says that the Hindus express a stimulating oil from common garlic, which they prescribe internally in ague to prevent the recurrence of the paroxysms, and use externally in paralytic and rheumatic affections. Garlic is called "Vullay poondoo" in Tamul; "Lassun" in Hindostanee; and "Lasuna" in Sanscrit.

ORONTIACEÆ.

ACORUS CALAMUS, *Linn.*

The rhizomes of the common Sweet-Flag are well known in some parts of England as a cure for ague, and the natives of the East are well aware of their virtues in this respect. Indian practitioners also reckon it valuable in the "indigestions, stomach-aches, and bowel affections of children," so much so, indeed, that, according to Ainslie, "there is a penalty incurred by any druggist who will not open his door in the middle of the night and sell it if demanded." The Bengalese call it "Shwet buch;" the Cinghalese, "Wadakaha;" and the Hindus, "Bach."

POTHOS SCANDENS, *Linn.*

The native practitioners use this plant in putrid fevers. It is an epiphyte with slender rooting stems adhering to the branches of trees like ivy, and has entire, lanceolate, smooth, coriaceous leaves, tapering upwards to a point and blunt and rounded at the base, where they are articulated with the winged stalk.

GRAMINACEÆ.

ANDROPOGON MURICATUS, *Retz.*

The fragrant aromatic roots of this grass, called Cuscus or Vetivert, are only employed for perfumery purposes in this country, but in India they are well known as the material of which window and door screens are made, and the native doctors, moreover, consider them to possess medicinal virtues, prescribing an infusion of them as a diaphoretic and gentle stimulant in some kinds of fever. "Vittie" is the Tamul name of the plant, and "Vayr" in the same language signifies *root*, and, by combining and corrupting these, Europeans have formed the word *Vetivert*; while its other European name, Cuscus, is derived from the Persian "Khus-Khus." In Hindustanee it is called "Useer;" and in Sanscrit "Viratara."

ANDROPOGON IWARANCUSA, *Roxb.*

The natives administer an infusion of the roots of this grass, combined with pepper, in fevers, of both the continued and intermittent kind. It has a bitter, warm, pungent taste, and fragrant odour. The specific name is derived from the Bengalee and Hindustanee, which is variously spelt "Ibharankusha," "Iwarankusha," "Kurankusha," or "Iwarancussa."

ANDROPOGON CALAMUS-AROMATICUS, *Royle.*

According to Royle, this is the κάλαμος ἀραματικός of the ancient Greeks, and the Sweet-cane or Calamus of the Bible. When chewed it has a strong taste of ginger, whence it is commonly called Ginger-grass. The native doctors give an infusion of it as a stomachic and febrifuge; and they also prepare from it a very fragrant aromatic oil, which they esteem very highly as a liniment in chronic rheumatism. This is sent to this country as grass-oil, or ginger-grass oil, and is sold by our perfumers as oil of geranium or spikenard.

APPENDIX D.

REPORT ON THE CULTIVATION OF CHINCHONAS IN SOUTHERN INDIA. BY WILLIAM G. McIVOR, ESQ., SUPERINTENDENT OF CHINCHONA-CULTIVATION IN THE NEILGHERRY HILLS.

Rearing Seeds.—The first sowing of imported seeds took place in the beginning of February 1860. No certain data being given for the treatment of Chinchona-seeds, our first operations were necessarily experimental, and a good number of seeds were lost by being sown in too retentive a soil, and supplied with what, to Chinchona-seeds, proved to be an excess of moisture; the greatest success we obtained in our first attempts was with the use of a soil composed almost entirely of burned earth, and of this sowing nearly sixty per cent. germinated, the temperature of the earth being about 70°. The number of days required before germination took place in the several sowings varied from sixty-two to sixty-eight. The seedlings made but little progress for the first six weeks, but after that time they sprung into rapid growth, averaging from 1¼ to 2 inches per mensem.

Seeds of the valuable Chinchona Condaminea, received on the 16th February 1862, were sown on the same day in a very light open soil composed of a beautifully open sort of sand, with a very small admixture of leaf-mould. Our experience with the first seeds having established beyond all doubt that the Chinchonas are very impatient of any excess of moisture, particular care was taken in the preparation of the soil used in this sowing. The earth was in the first instance exposed to the sun for two or three days and thoroughly dried, it was then heated to about 212° in order to destroy all grubs or larva of insects; after being allowed to cool, it was brought into the potting-shed and watered sufficiently to make it moist, but only to that degree of moisture that the particles of soil would not adhere together on being pressed firmly with the hand, that is, the earth on being laid down was sufficiently dry to break and fall into its usual form. With the soil in this state the pots were filled, the surface lightly pressed down, and the seeds sown thereon, being lightly covered with a sprinkling of sand. The pots were then placed on a slight bottom heat of about 72°. These were never watered in the strict sense of the word; when the surface got dry they were slightly sprinkled with a fine syringe just sufficient to damp the surface, but never to penetrate the soil. Under this treatment the seeds began to germinate very vigorously on the sixteenth day after sowing, and now, 17th March 1862, or twenty-nine days after sowing, upwards of sixty per cent. of the

whole of the perfect seeds sown have germinated, and we may fairly hope to rear over ninety per cent. of this sowing. I may, however, observe that these seeds possessed the great advantage of being forwarded to India in a letter, and thus they were never subjected to the damaging effects produced on seeds sent out in air-tight parcels. The reason of this is the want of a circulation of air through the packets, and a consequent deposit of moisture on the interior of the outer covering by every increase and decrease of temperature on the voyage. As soon as the seeds germinate they are carefully pricked out into fresh pots (the soil being prepared as before described for the seeds). This must of course be done with very great care, the radicle being carefully covered with soil, while the seed and cotyledons are kept above the surface. In this way about twenty-five seedlings are transplanted into a four-inch pot, and treated in every respect the same as the seeds; that is, they are never watered, the soil being merely sprinkled as before stated to keep it in that medium state of moisture in which it was first put into the pots. This prevents the damping off of the seedlings, to which they are very liable when treated otherwise; it also greatly facilitates their growth and the formation of roots, the soil being so perfectly open that it is readily affected by the atmosphere, and thus kept in the most favourable condition for promoting vegetation. When treated in this way our seedlings have made an average growth in ten months of over eighteen inches, the growth being much more rapid towards the end of the ten months than in the earlier stages.

Propagation.—As soon as the seedlings and imported plants attained sufficient size, they were propagated by being layered; in this way it was found that they rooted readily in about six weeks or two months, and threw out shoots from every bud; and not only this, but many latent buds were developed, and a fine growth of young wood produced for succeeding layers and cuttings. The principle of layering, being so well known to English gardeners, requires no detail; but in the Chinchona-plants it was found that the layers were very liable to *bleed*, and this not only weakened the plants but retarded the formation of roots; this we found to be remedied in a great degree by inserting in the cut a triangular piece of perfectly dry broken porous brick. An abundance of young wood being produced, we proceeded to propagate by cuttings, the earth being prepared with great care, the same as for the seeds, with the exception of not being heated. The ends of the cuttings are placed upon pieces of perfectly dry porous brick, around the sides of the pots. They are then placed on a bottom heat of 75° or 80°; and, with this treatment, young and tender wood roots in about three weeks or one month, older wood in about six weeks to two months. With cuttings of the young wood our loss has not exceeded two per cent., and with older wood about ten per cent.

Our object being to produce the largest number of plants in the shortest possible space of time, it was found that cuttings and layers required more wood than could be conveniently spared, and it was resolved to try the propagation by buds; in this respect the success has been most satisfactory. The secret of success entirely lies in the amount

of moisture given; if in excess, they rot immediately, but, if sufficient care is exercised in reference to moisture, the losses will not exceed three or four per cent. Six C. Calisaya buds put in on the 30th January all rooted in forty-one days. It may be observed that it is not necessary that a leaf should be attached to the bud: this is no doubt an advantage, although we have struck many buds of the red bark without leaves, and also a few of the Calisayas.

It ought to be explained that the reason why the earth is brought to a medium state of moisture before being put into the pots is because it is never afterwards watered to such an extent as to render it really wet, being in fact just kept in that state of moisture in which it was originally placed in the pots, and this uniform and medium state of moisture is more easily retained by the pots being plunged in beds of earth. The reason why we found this system necessary was, that, when the soil was watered in the usual way after the seedlings or cuttings were placed in it, it was found, from its expansion and adhesion by the action of the water, that its particles were forced far too close together to be beneficial to the growth of the plants, and in many instances this proved to be injurious, vastly retarding their growth.

In the nurseries in the open air the same principle of cultivation and propagation as that described above has been adopted, and, with reference to the condition of the plants and layers, with nearly equal success, the period of rooting of the layers being from two months to ten weeks, while cuttings take from two to three months, the average loss being about fifteen per cent.: this occurs from the impossibility, in the open air, of keeping a uniform state of the atmosphere around the cuttings. With layers this is not so important, as they root quite as surely (though slower) as in the propagating-houses, and flourish equally well.

Formation of Plantations.—The mode of cultivation of these plants likely to prove the most advantageous being uncertain, it was resolved in May and June of 1861 to place out a number of plants under different conditions of shade, exposure, &c., and the result has been that the plants placed without the protection of living shade have made the most satisfactory progress, and borne the dry season without the least injury. The plants placed under living shade were found to be damaged in some degree during the rains by the incessant drip, but on the weather clearing up they threw out new leaves and quickly recovered. Nine months after planting, or at the end of our dry season, these plants were found to be suffering considerably from the drought; and on taking a few of them up, it was found that the holes in which these Chinchonas were planted had become entirely filled by the fibres of the roots of the living trees in their neighbourhood, which had drawn up the whole of the moisture and nourishment from the soil in which the Chinchona-plants were placed. In putting the plants out, which were placed in the open, we of course saw from the first that with the young plants we had to combat the bad effects of excessive evaporation during our dry season, under a bright and scorching

sun; we also saw the injury likely to be done to the plants by radiation during bright and cloudless nights. To obviate these disadvantages the plants were sheltered on the approach of the dry season by a rough enclosure of bamboo-branches, with the leaves adhering to them, so as to give them sufficient shade both from the effects of evaporation and radiation. The enclosure is left open on the north side, and enclosed on the south, east, and west; the sun's declination being south during the dry weather. The ground will not be impoverished by the roots of other trees, and the whole of its nourishment is preserved for the Chinchona-plants. At the same time they will, by this treatment, be far more efficiently protected from evaporation and radiation than they would be by the use of living shade, whether caused by forest-trees or by the admixture of faster-growing plants. In addition to this shade of the branches of cut bamboos, the soil around the roots of some of the young Chinchona-plants was covered one or two inches in thickness with half-decayed leaves, and the plants thus treated show a very great luxuriance, which is not exceeded by any of the plants in our propagating-houses. To ascertain the cause of this luxuriance a few of the plants were recently examined, and although at the end of the dry season the soil about the roots was found to be perfectly moist; thousands of young rootlets of great strength were found to have been thrown into the covering of decayed leaves, so that it had become one matted mass of beautiful white roots, many of them nearly the thickness of a crow-quill. On the strength of these observations we have resolved to place out this season seventy-five acres of Chinchona-plants in cleared land, and exactly under the conditions and treatment last described; we also propose planting seventy-five acres under various degrees of living shade, in which every attempt will be made to mitigate as much as possible the injurious effects of this system already described. The cultivation of these plants being experimental, it is necessary that we should give every method of cultivation which appears reasonable a fair trial, and that only developed facts should influence us in giving preference to one method of cultivation over that of another. The distances at which we have prepared to place the plants are for the larger growing species from nine to ten feet apart, for the sorts of medium size eight feet, and for the shrubby sorts seven feet: these distances are of course too close to admit of the plants attaining a full size, but we believe that it will be advantageous to plant them close in the first instance, and thin them out afterwards. In order to illustrate the extreme growth of our plants, it is worthy of note that one or two of them, although not yet twelve months old, have attained a height of about five feet by three and a half feet in diameter through the branches; we may therefore conclude that the plants will in about two years fairly cover the ground if placed at the distances given above. When they begin to crowd and impede the growth of each other they will of course be thinned out and pruned; and it is anticipated that a good supply of bark may be obtained by these means in from eight to twelve years, or perhaps earlier.

Ootacamund, 19th March, 1862.

P.S. On the 5th of April the seeds of *C. Condaminea* were coming up plentifully, and 4193 seedlings had already been transplanted. 100 seedlings of *C. crispa* had also come up. The seeds of *C. Condaminea* were coming up at the rate of 500 a-day. At this date there were 25,000 Chinchona-plants on the Neilgherry hills, and all the species, except *C. lancifolia*, were increasing rapidly. It will be some time before Mr. McIvor will be able to propagate from the latter species, owing to the very unhealthy state in which the plants arrived from Java. In April 50 acres of ground were prepared for planting at the Dodabetta site, and 70 acres at Neddiwuttum.

APPENDIX E.

NOTE ON THE EXPORT TRADE IN PERUVIAN BARK FROM THE PORTS OF SOUTH AMERICA, AND ON THE IMPORT TRADE INTO ENGLAND.

ARICA, the port for the "*Calisaya*" bark from Bolivia. In 1859 the export of bark amounted to 192,600 lbs., valued at 17,334*l.*; and between January and November, 1860, to 388,800 lbs., valued at 35,000*l.*

ISLAY, another port for the "*Calisaya*" bark from Bolivia. In 1859 the export of bark amounted to 146,000 lbs., valued at 13,460*l.* (of which 136,500 lbs. went to England, and 9500 lbs. to France); and between January and November, 1860, to 107,700 lbs., valued at 9770*l.*

PAYTA, the port for the "*Crown*" barks from Loxa. The price of bark at this port for the last nine years has been twenty-four dollars the cwt.; but during the last year the price has risen to thirty dollars, where it is likely to remain for some time. The usual annual export amounts to 140,000 lbs., the actual quantity shipped in 1861, and it is valued at 8400*l.*

GUAYAQUIL, the port for the "*Red*" bark and the "*West Coast Carthagena*" bark. The quantity exported varies very much in different years, the price being at present about twenty dollars the cwt. In 1857 the export of bark amounted to 516,600 lbs.; in 1858 to 533,300 lbs.; in 1859 to 201,700 lbs.; in 1860 to 91,500 lbs.; and in 1861 to 443,700 lbs.; valued in the last of these years at 17,748*l.*

The "*Grey*" barks were exported, in former years, from CALLAO, and in small quantities from HUANCHACO and LAMBAYEQUE, but of late years none has been exported.

The "*Carthagena*" barks from New Granada are exported from the ports of CARTHAGENA and SANTA MARTHA, and also from the little port of TUMACO on the Pacific coast. From 1849 to 1855 great quantities were exported, but in the latter year the supply began to fail. The existing civil war in New Granada has still further injured this trade. No reliable account of the export of bark from the above ports of New Granada has been received.

From the four ports of ARICA, ISLAY, PAYTA, and GUAYAQUIL the average amount of bark annually exported may be taken at 912,900 lbs., valued at 59,076*l.* Small quantities may come from other ports, of which no authentic account has been obtained; so that the total

amount annually exported from South America may be estimated at considerably over 2,000,000 lbs.

There being no duty on the importation of Peruvian bark into England, the returns of the amount imported are much less carefully kept than was formerly the case. The returns, too, are in packages, and not in lbs. or cwts., and these packages vary in weight from 120 lbs. to 60 lbs. The number of packages of Peruvian bark imported into England in 1858 was 19,831; in 1859 the number was 10,651; in 1860 it was 10,456; and in 1861 it was 20,748. Taking the average of the weight of the packages at 80 lbs. each, the quantity imported into England during the last four years would be 4,934,880 lbs., and in the year 1861 about 1,659,840 lbs.

The quantity of Peruvian bark imported into England during the three months ending on March 31st, 1861, was reported to be 306,300 lbs., and during the same period, in the present year, 310,700 lbs. At this rate the annual import would be a little over 1,200,000 lbs., which is probably more correct than the above estimate from the packages.

THE END.

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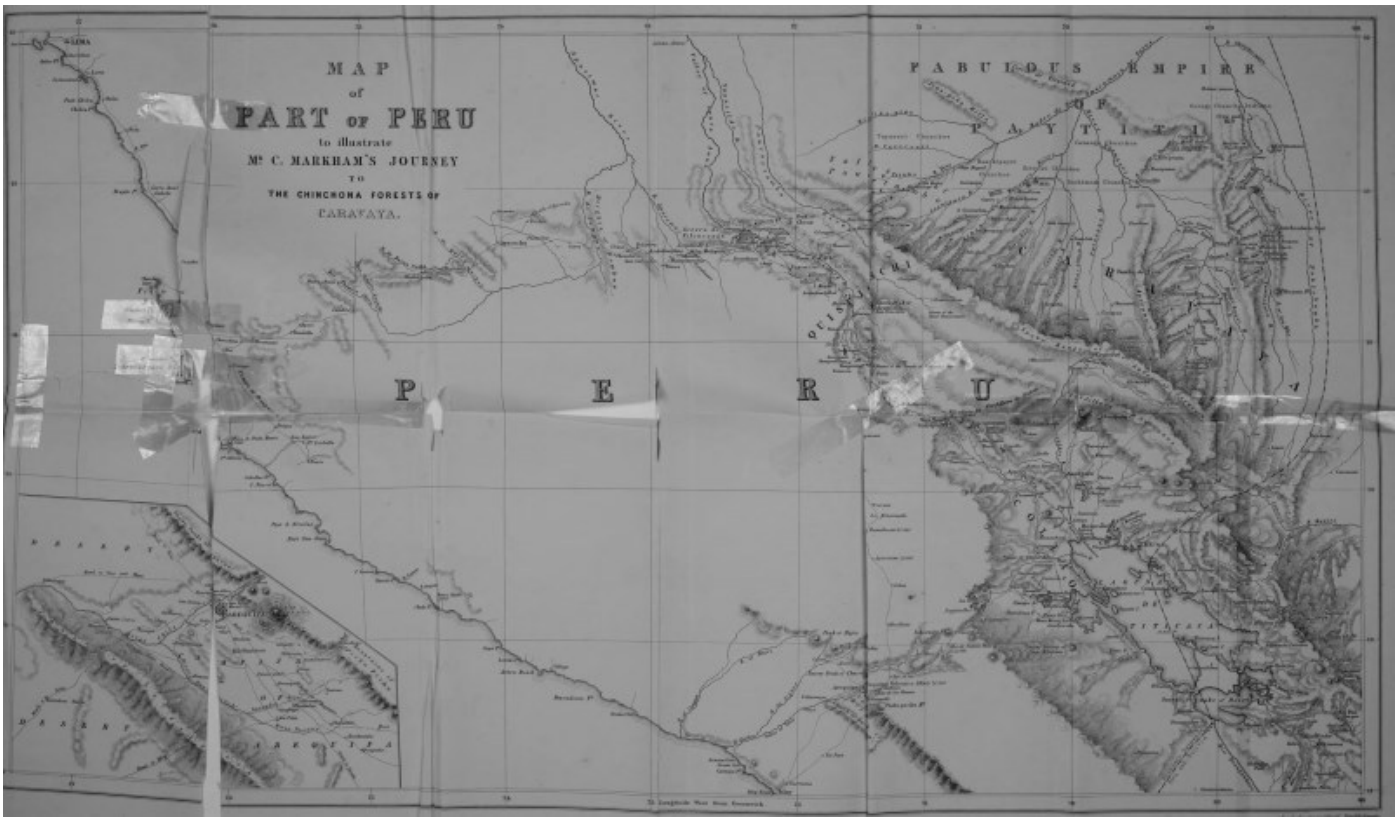

MAP
of
PART OF PERU
to illustrate
Mr. C. MARKHAM'S JOURNEY
TO
THE CHINCHONA FORESTS OF
CARAVAYA.

FOOTNOTES:

[1] The only valid argument against this change is that it may cause confusion, but the alteration is too slight for this to be possible; and it is not uncommon, among botanists, to correct the usual spelling of genera or species of plants, when it is found to be erroneous. Among other examples of such changes may be enumerated those of *Plumeria*, now altered to *Plumieria*; *Bufonia* to *Buffonia*; and *Gesneria* to *Gesnera*.

[2] *See page 490.*

[3] In Quichua, when the name of a plant is reduplicated, it almost invariably implies that it possesses some medicinal quality.

[4] La Condamine, Jussieu, and Ruiz all believed that the Indians were aware of the medicinal qualities of Peruvian bark, and that they imparted their knowledge to the Spaniards. Humboldt and Ulloa were of an opposite opinion. The stories of its virtues having been discovered by watching the pumas or South-American lions chewing the bark to cure their fevers, mentioned by Condamine; and of an Indian having found it out by drinking of the waters of a lake into which a chinchona-tree had fallen—told by Geoffroy—are of modern and European origin.

[5] Jussieu says that it is certain that the first knowledge of the efficacy of this bark was derived from the Indians of Malacotas, some leagues south of Loxa.—Weddell, *Histoire Naturelle des Quinquinas*, p. 15.

[6] Poëppig, *Reise*.

[7] Mr. Spruce's *Report*, p. 25.

[8] The first Marquis of Astorga married Leonora, daughter of Don Fadrique Henriquez, Admiral of Spain, and sister of the Queen of Aragon, who was mother of King Ferdinand the Catholic: so that Ana was sixth cousin to her contemporary King Philip IV

[9] *Nobiliario genealogico de los Titulos de España, por Alonzo Lopez de Haro, Madrid, 1626.*

[10] Alcedo.

[11] *Creacion y Privilegios de los Titulos de Castilla, por Don José Berni.* The Counts of Chinchon were hereditary Alcaides of the Alcazar of Segovia. In 1623 the Count of Chinchon here received Charles I. of England, and gave him a supper of "certaine trouts of extraordinary greatnesse." In 1764 the then Count of Chinchon ceded the Alcazar to the crown.

[12] A large supply of seeds of this kind has been sent to India and Ceylon.

[13] Howard's *Nueva Quinologia de Pavon*, No. 1.

[14] Sebastian Badus asserts that bark was brought to Alcala de Henares as early as 1632.—Humboldt's *Aspects*, ii. p. 268.

[15] I translated and edited Acuña's Voyage for the Hakluyt Society in 1859.

[16] *Disertacion por Dr. Don Hipolito Unanue.*

[17] Torti's work, *De Febribus*, was published at Venice in 1732.

[18] *Traité Thérapeutique du Quinquina*, par P. Briquet. Paris, 1856.

[19] *Voyage de Condamine*, p. 31.

[20] 1738, p. 226.

[21] *Noticias Secretas*, p. 572.

[22] *Semanario de la Nueva Granada*, p. 283.

[23] Endlicher separated the species whose capsules begin to open from the top, and formed them into a sub-genus, which he called *Cascarilla*. Klotzsch, combining these with other species characterised by a six-parted corolla, raised them to an independent genus called *Ladenbergia*.

[24] *Histoire naturelle des Quinquinas*, p. 72.

[25] Dr. Weddell's list is as follows:—

1. C. Calisaya	(*Weddell*)	Bolivia and Caravaya.
2. C. Condaminea	(*Humboldt*)	Loxa.
3. C. Scrobiculata	(*Humboldt*)	Peru.
4. C. Amygdalifolia	(*Weddell*)	Peru and Bolivia.
5. C. Nitida	(*Ruiz and Pavon*)	N. Peru.
6. C. Australis	(*Weddell*)	Southern Bolivia.
7. C. Boliviana	(*Weddell*)	Caravaya and Bolivia
8. C. Micrantha	(*Ruiz and Pavon*)	Peru and Bolivia.
9. C. Pubescens	(*Vahl*)	Peru and Bolivia.
10. C. Cordifolia	(*Mutis*)	New Granada.
11. C. Purpurascens	(*Weddell*)	Bolivia.
12. C. Ovata	(*Ruiz and Pavon*)	Peru and Bolivia.
13. C. Chomeliana	(*Weddell*)	Bolivia.
14. C. Glandulifera	(*Ruiz and Pavon*)	N. Peru.
15. C. Asperifolia	(*Weddell*)	Bolivia.
16. C. Humboldtiana	(*Lambert*)	Jaen.
17. C. Carabayensis	(*Weddell*)	Caravaya.
18. C. Mutisii	(*Lambert*)	Loxa.
19. C. Hirsuta	(*Ruiz and Pavon*)	N. Peru.
	Doubtful.	
C. Discolor	(*Klotzsch*)	N. Peru.
C. Palalba	(*Pavon*)	Peru.

[26] M. Delondre decided that the fruit and flowers, though having a bitter principle, did not contain the alkaloids, while the roots contained them, though in smaller proportion than the bark of the trunk and branches.

[27] Weddell.

[28] Briquet, p. 22.

[29] *Nueva Quinologia de Pavon*, No. 10.

[30] *Aricine*, as a sulphate, does not crystallize, but forms a peculiar trembling jelly. It was so named from the port of Arica, whence the bark of *C. pubescens* is exported.

[31] Pereira says that, if a substance suspected to contain *quina* be powdered, then shaken with ether, and afterwards successively treated with chlorine and ammonia, the liquid will assume a green colour if the slightest trace of quina be present.—*Mat. Med.* ii. part ii. p. 119. One or two pounds of bark suffice well for an analysis.

[32] *Traité Thérapeutique du Quinquina et de ses préparations*, par P. Briquet, Paris, 1855. Also Pereira's *Materia Medica*.

[33] The word *quinquina* is generally adopted for the medical preparations which are taken from Peruvian bark. *Quina* signifies *bark* in Quichua, and *quinquina* is a bark possessing some medicinal property. *Quinine* is, of course, derived from *quina*, *chinchonine* from *chinchona*. The Spaniards corrupted the word *quina* into *china*; and in homœopathy the word *china* is still retained. In 1735, when M. de la Condamine visited Peru, the native name of *quina-quina* was almost entirely replaced by the Spanish term *cascarilla*, which also means bark.

[34] *Autobiography of Sir James MacGrigor*, chap. xii. p. 241.

[35] *Dictionnaire des Sciences Médicales*, quoted by Delondre, p. 7.

[36] *Aspects*, ii. p. 267.

[37] *Semanario de la Nueva Granada.*

[38] From Martius: a note in No. 1 of Howard's *Nueva Quinologia de Pavon*.

[39] Some of these MSS. are, I believe, in possession of Don Pedro Carbo, of Guayaquil.

[40] Spanish edition of General Miller's *Memoirs*, i. p. 42.

[41] It is the form of *C. Condaminea*, represented in the unshaded branch with capsules, Plate x. of the *Plantes Equinoctiales*.

[42] It comes in very small quills, as if taken from a mere shrub.

[43] Besides *quinine* several other febrifugal alkaloids are found in the chinchona barks, one of the most important of which is *chinchonidine*, discovered by Pasteur in 1852.

[44] I found some very beautiful dried specimens of this species in the botanical gardens at Madrid last year. The lanceolate leaves and panicles of flowers still retained their colour. They were marked "*Cascarilla fina de Uritusinga de Loxa, Quin. de Pavon*."

[45] Howard's *Nueva Quinologia de Pavon*.

[46] *Howard*, from MS. of Ruiz.

[47] Mr. Cross's *Report*, Nov. 1861.

[48] Pereira, *Materia Medica*, ii. p. 106.

[49] Afterwards published in a pamphlet of 57 pages, with plates.

[50] In 1856 Mr. Howard shared Dr. Weddell's belief that the "red bark" belonged to a variety of *C. ovata*.—*Pharmaceutical Journal*, Oct. 1856.

[51] Howard.

[52] With "red bark" another kind, known as "West coast Carthagena," is exported from Guayaquil. The name is absurd. Mr. Howard believes it to be derived from the *C. Palton* of Pavon, which is found in the woods of Cuenca, and in the province of Loxa. Samples of this bark yield 2.05 of alkaloids, 1.34 of chinchonidine, and 0.7 of quinine.

[53] Alcedo.

[54] Mutis was born at Cadiz in 1732. He resided in South America for forty years, and corresponded with Linnæus. Dying in 1808, the greater portion of his papers was destroyed in the revolution at Bogota; but a part of his collection of dried plants is now in the botanical gardens at Madrid, in a disgraceful state of disorder.

[55] In 1776 Don Sebastian José Lopez Ruiz, a physician at Bogota, persuaded the Spanish government that he was the first discoverer of chinchona-trees in New Granada, and obtained a yearly pension of 2000 dollars as a reward; but he was afterwards considered to be an impostor, and the viceroy deprived him of it.

[56] The pupil and fellow-workman of Mutis, from whose notes he wrote.

[57] *Anales de la Historia Natural de Madrid*, 1800.

[58] *Floræ Columbiæ specimina selecta*, i. p. 21: Berlin, 1858. A superbly illustrated work by Dr. Karsten.

[59] *Die medicinischen Chinarinden Neu-Granadas*, von H. Karsten: Berlin, 1858. I have had this pamphlet translated for the use of those intrusted with, or interested in, the chinchona cultivation in India and Ceylon. It contains a great deal of valuable information respecting the most favourable situations for the production of alkaloids in chinchona barks, and other particulars respecting the growth of the bark, and the methods of collecting it. Dr. Karsten is a careful observer and a scientific botanist and chemist, and his observations form a very important addition to our knowledge of this subject.

[60] *Report of the Administrador Don Ignacio Cavero, Semanario*, p. 183.

[61] 300 dried specimens, and 242 coloured drawings, sent in the ship 'Buen Consejo.'

[62] Namely:—

1.	*C. lanceolata*	(*Cascarilla bobo amarillo*).
2.	*C. purpurea*	(„ *de hoja morada*).
3.	*C. ovata*	(„ *pata de gallareta*).
4.	*C. nitida*	(„ *fino*).
5.	*C. hirsuta*	(„ *fino delgado*).
6.	*C. magnifolia*	(„ *flor de Azahar*).
		(„ *magnifolia—Wedd*).
7.	*C. glandulifera*	(„ *negrilla*).

[63] I have examined Pavon's dried specimens from Huanuco, now in the botanical gardens at Madrid.

There are leaves of *C. lanceolata*, from the forests of Muña; leaves and capsules of *C. ovata*, some of the former very slightly cordate, from Panao and Pillao; leaves, flowers, and capsules of *C. purpurea*; and leaves and capsules of *C. nitida*, from Cuchero.

[64] Ruiz published his *Quinologia* in 1792.

[65] At first, in the best years, as many as 25,000 arrobas of bark were exported from the province of Huanuco, and some large fortunes were made.—*Poeppig*. An arroba = 25 lbs.

[66] *Mercurio Peruano.*

[67] A Peruvian who was for many years Director of the Cabinet of Natural History in Madrid, during the reign of Charles III.

[68] *Reise in Peru, während der Jahre 1827-32*, von Eduard Poeppig, Professor an der Universität zu Leipzig, ii. pp. 217-23, 257-64.

[69] Stevenson, however, says that large quantities of bark were brought from the woods east of Huamalies in 1825.—*Travels*, ii. p. 66.

[70] Poeppig. Van Tschudi, p. 399.

[71] Poeppig.

[72] Howard.

[73] I have caused the part of Poeppig's work which relates to chinchona-trees and their barks to be translated for circulation in India and Ceylon.

[74] As early as 1790 the calisaya bark was highly prized in Madrid.

[75] The valuable species found in Bolivia and Southern Peru. Dr. Weddell derives the name from the Quichua words *colli* (red) and *saya* (form); Poeppig from *colla* (a remedy) and *salla* (rocky ground); Van Tschudi from *collisara* (reddish maize). Dr. Laefdael, the Judge of Caravaya, told me it came from *ccali* (strong) and *sayay* (become, or be thou). Calisaya is the name of a family of Indian Caciques in Caravaya, one of whom acted an important part in the revolt of 1780-1. The plant may have been called after him.

[76] The bark of *C. Calisaya*, known as "yellow bark" in commerce, was at first erroneously believed to come from *C. cordifolia*, because Mutis had called the bark from that species *cascarilla amarilla*, or "yellow bark." See p. 28.

[77] This account of the Bolivian bark trade is from Dr. Weddell's *Voyage dans le Nord de Bolivie, et dans les partes voisines de Pérou*. Paris, 1853. Chap. xiii. p. 235.

[78] Gibbon's *Valley of the Amazon*, p. 147.

[79] *Mercurio del Vapor*, Dec. 15, 1859.

[80] *Yuncu* is a tropical valley in Quichua, hence *yungus*, a Spanish corruption of the same word.

[81] *Quinologie*, par M. A. Delondre. Paris, 1854.

[82] *Voyage dans le Nord de Bolivie, et dans les partes voisines de Pérou*, par H. A. Weddell. Paris, 1853. Dr. Weddell is now engaged in the publication of a work on the plants of the more elevated parts of the Andes, entitled *Chloris Andina*.

[83] An account of it was published in the Journal of the Horticultural Society, vol. vii. p. 272.

[84] Pereira, *Mat. Med.* ii. part ii. p. 118.

[85] Weddell, *Histoire Naturelle des Quinquinas*.

[86] Weddell, *Voyage dans le Nord de Bolivie*.

[87] *Mém. de l' Acad. Roy. des Sciences*, 1738, p. 226.

[88] *Noticias Secretas*, p. 572.

[89] MS. quoted by Howard.

[90] Poeppig.

[91] Karsten.

[92] I. p. 245. Probably the idea was first conceived much earlier by Dr. Ainslie, who, half a century ago, remarked that it was matter of regret that "it had never been attempted to rear those articles of the Materia Medica in India, for which the world is now solely indebted to America."—Ainslie's *Materia Medica*, p. 66 (*note*).

[93] *Cours d'Hist. Nat. Pharm.* ii. p. 252.

[94] *Histoire Naturelle des Quinquinas*, p. 13.

[95] *Quinologie*, par M. A. Delondre, p. 15.

[96] So convinced is Dr. Weddell that there is imminent danger of the supplies of bark eventually being exhausted, that he says, "Avant que la malheur que je prévois n'arrive (et ce ne sera pas de notre temps) la science aura peut-être fait la conquête de quelque nouveau médicament qui rendra moins regrettable la perte de l'écorce de Pérou."—*Voyage dans le Nord de Bolivie*, p. 245.

[97] Howard.

[98] Howard.

[99] *Ychu* is grass in Quichua, and *corpa* a lodging.

[100] Information from Gironda, then Governor of Sina.

[101] *Kew Miscellany*, Oct. and Nov. 1856.

[102] Dr. Macpherson's Report, Dec. 19, 1860, No. 50, para. 8.

[103] *Bonplandia*, March, 1859, p. 72. The pay of an Assistant-Resident in Java is 500*l.* a-year.—Money's *Java*.

[104] A lofty tree, 150 to 200 feet high, with a very close-grained wood. It yields a fragrant resin called *storax*.

[105] Report of Mr. Fraser, H. M. Consul at Batavia.

[106] Dr. Junghuhn called some of the plants *C. lanceolata*, and others *C. succirubra*; but he has himself allowed that the former are a mere variety of the worthless species, seeds of which were sent by M. Hasskarl from Uchubamba; and the latter certainly cannot be *C. succirubra*, as that valuable kind is not found in the Peruvian districts visited by M. Hasskarl.

[107] Dr. Macpherson's Report, Dec. 19, 1860. No. 50.

[108] Dr. Anderson's Report, Dec. 14, 1861, No. 326; and Dr. Macpherson's Report, Dec. 19, 1860, No. 50, para. 12.

[109] Report of Mr. Fraser, late H. M. Consul at Batavia.

[110] Howard's *Nueva Quinologia de Pavon*. No. 7.

[111] He left Java in September, 1861, after a residence of six years.

[112] Howard. No. 7 (*note*).

[113] Report of Mr. Fraser.

[114] Dr. Junghuhn has published two very interesting reports on the cultivation of the chinchona-plants in Java, in the *Bonplandia*, a German botanical journal: the first in Nos. 4 and 5 of 1858, and the second in the numbers for July and August, 1860. I have caused these reports to be translated and circulated for the information of those who are intrusted with, or interested in, the chinchona cultivation in India or Ceylon.

[115] Mr. Spruce's remark on the eventual necessity of cultivating the chinchona tree is important. He says, "I have seen enough of collecting the products of the forests to convince me that *whatever vegetable substance is needful to man, he must ultimately cultivate the plant producing it*."—*Report*, p. 83.

[116] It appears, by a government return, that 2051 lbs. of quinine were sent to India in 1856, and 1180 lbs. in 1857.

The *Friend of India* of December 10th, 1860, however, quoting from the *Lancet*, states that the consumption of quinine and bark in the government hospitals in India in 1857-8 was 6815 lbs., and that in 1858-9 it amounted to 5087 lbs. The writer of the article adds that the government druggists in India sell quinine at 1*l.* an ounce; but, taking the cost of an ounce of quinine at 10*s.*, the expenditure on this medicine, according to the above figures, would amount to 54,520*l.* in 1857-8, and to 40,696*l.* in 1858-9!

[117] Nevertheless we now have plants of *C. lancifolia*, the species which should have been procured from New Granada, thriving in India. They have been received from Java, in exchange for other species, and were originally

raised from seeds sent by Dr. Karsten.

[118] When it was founded by General La Fuente, then Prefect of Arequipa.—*Castelnau*, iii. p. 443.

[119] There is anchorage for 20 or 25 vessels in 10 or 12 fathoms; but there is always a rather heavy swell, so that a hawser is necessary to keep a vessels bow to it, even in fine weather.

[120] In the following proportions:—

To England	Alpaca wool	22,500	cwts	worth	£192,729
"	Sheep's wool	18,669	"	"	67,306
"	Vicuña wool	72	"	"	1,537
"	Copper			"	333
"	Bark	1,365	"	"	12,383
"	Specie				34,706
To France	Wool	877	"	"	1,886
"	Bark	95	"	"	1,077
To the United States	Wool	8,054	"	"	24,884
					£336,842

[121] The analysis of this soil, by Dr. Forbes Watson, gave the following result:—

Water, and a little organic matter	7.100
Silica, as silicate and as silex	59.800
Peroxide of iron	12.100
Alumina	12.300
Lime	4.100
Magnesia	2.100
Soda	0.724
Chloride of sodium	0.408
Phosphoric acid	0.117
Carbonic acid	
Sulphuric acid	0.082
	99.681
Loss	.319
	100.000

[122] "Tambo" is a Spanish corruption of the Quichua word *Tampu*, an inn or post-house.

[123] Almost all the woollen clothing of the Peruvian Indians is now imported from Yorkshire, and their shirtings from Lowell. Formerly it was all of home manufacture.

[124] Probably from the Quichua word *Chiri*—cold.

[125] *El Peru en* 1860, por Alfredo Leubel.

[126] The republic of Peru has had 37 years and 7 months of existence, of which *28 years and 8 months* have been passed in peace, 2 years in foreign war, and 6 years and 11 months in civil dissensions.

1824 to 1828 inclusive	At peace.
Jan. to July, 1829	At war with Colombia.
July, 1829, to the end of 1833	At peace, under President Gamarra.
Jan. 1834, to Feb. 1836	In civil dissensions.
Feb. 1836, to Aug. 1838	At peace, under General Santa Cruz.

Aug. 1838, to Jan. 1839	At war with Chile.
Jan. 1839, to Jan. 1841	At peace, under President Gamarra.
Jan. 1841, to July, 1841	In civil dissensions.
July, 1841, to June, 1842	At war with Bolivia.
Aug. 1842, to July, 1844	In civil dissensions.
July, 1844, to June, 1854	At peace under Presidents Castilla and Echenique.
June, 1854, to Jan. 1855	In civil war.
Jan. 1855, to Oct. 1856	At peace, under President Castilla.
Oct. 1856, to March, 1858	An insurrection at Arequipa.
March, 1858, to March, 1862	At peace, under President Castilla.

These are the plain facts of the case, which are preferable to vague and ignorant statements that Peru has been in a constant state of civil war ever since the War of Independence.

[127] The elevations were taken with one of Negretti and Zambra's boiling-point thermometers.

[128] So called from being covered with small round pebbles, like comfits.

[129] At this elevation grows an asclepiad (*Pentagonium flavum*), a little lowly plant with yellow flowers.—*Chloris Andina*, ii. p. 49.

[130] *Baccharis Incarum* of Weddell.—*Chloris Andina*, i. p. 170.

[131] Dr. Weddell mentions a composita (*Merope piptolepis*) as being common near the shores of these lakes.—*Chloris Andina*, i. p. 162. And an oxalis in the crevices of the rocks near La Compuerta.—*Oxalis Nubigena*, ii. p. 291.

In the neighbourhood of La Compuerta there are several other lowly alpine plants—a St. John's wort (*Hypericum brevistylum*), another oxalis, and two mallows, &c. &c.

[132] M. de Castelnau says that vessels exactly resembling those of lake Titicaca are represented on the tomb of Rameses III. at Thebes.

[133] Gonzalez Montoya was the best Governor that Puno has ever known. He was a benevolent as well as a determined man, and abolished the *mitas*, or drafting of Indians for forced labour in the mines of Potosi. When ordered by the Government to restore the *mitas*, he replied, "Obedesco pero no cumplo."

[134] Garcilasso de la Vega says that the Indians boil the leaves of the *sunchu*, and then dry them in the sun, and keep them to eat in the winter.—I. lib. 8, cap. xv. p. 284.

[135] In 1663 the mines of Laycaycota, Cancharani, and San Antonio de Esquilache, near Puno, produced 1,500,000 dollars' worth of silver in one year!—Miller's *Memoirs*, ii. p. 238.

[136] *Compendio del hecho y apuntamiento de derechos de Fisco, en la causa contra José de Salcedo, sobre las sediciones y tumultos del asiento de minas de Laycocota. Papeles Varios* 2, in the National Library at Lima.

[137] This was the Count of Medellin who married Catalina Ponce de Leon, sister of the Duchess of Gandia, whose husband was brother of the Countess of Lemos.

[138] *Declaracion de todo lo que contiene la demonstracion hecha por los Vehedores Don Juan Eusebio Ximenes, y Don Valentin Calderon de la Barca, de Orden Real, a Cancharani, Laycocota la alta, y Laycocota la baja, sus situaciones y vetas, desde la villa de Puno en distancia a una legua a cuya falda esta la gran laguna de Chucuito*, 1718. MS. Report at Puno, with a map, which has unfortunately been lost.

[139] The men who broke out the ores with picks got 5 rials a day; and 6 men worked out 6 to 8 cwts. of mineral daily, working 12 hours. The rest of the workmen got 4 rials a-day

[140] A small shrub (*Baccharis Incarum*) often covering the hills.

[141] It yields about 30 per cent. of silver.

[142] In 1845 Bustamante placed the value of the exports at 2,500,000 dol.!

[143] From the *Geografia del Peru*. Lima, 1859.

[144] An Englishman had a schooner on the lake, but I believe she is now abandoned or broken up; and there is no craft at present but the reed balsas.

[145] The Peruvian Government answered this decree in a noble spirit, by declaring that they would not retaliate, but, on the contrary, would assist commercial traffic between the two countries by every means in their power. Linares rescinded his barbarous edict on October 17th.

[146] All the bark shipped at Islay is smuggled across the Bolivian frontier; Arica is the recognised port of Bolivia; and the bark exported from Payta comes from the neighbouring republic of Ecuador.

[147] Evaporation, however, goes on at all seasons, owing to the excessive elevation of the waters.

[148] So say the people of Puno, but the island is all limestone.

[149] The name is more modern; given, as tradition relates, by one of the Incas, who happened to be encamped here when a *chasqui* or messenger arrived with extraordinary rapidity from Cuzco. The Inca exclaimed, "*Tia-huanaco!*" "Be seated, O Huanaco!"—the huanaco being the swiftest animal in Peru.

[150] The Hindoo god Siva is also represented with a necklace of human heads.

[151] For descriptions of the ruins at Cuzco, see my former work, *Cuzco and Lima*, chap. iv. and v.

[152] It is now introduced into our greenhouses.

[153] The lizard appears to have been a favourite device amongst the ancient Aymaras. There is also one carved on a block of stone amongst the ruins of Tiahuanaco.

[154] The idol of Copacabana was made of a beautiful blue stone, hence the name. It had an ugly human head, and a fish's body, and it was adored as the God of the Lake.

[155] Calancha.

[156] Facing the road on the mainland, between Juli and Pomata.

[157] He nominated Apu Inca Sucso, a grandson of the Inca Viracocha, as Governor; who was father of Apuchalco Yupanqui, the grandfather of Don Alonzo Viracocha Inca, and his brother Don Pablo, who governed the island of Titicaca, under the Spaniards, in A.D. 1621.

[158] Fray Alonzo Ramas says that in 1611 an old woman, aged 120 years, died at Viacha, a day's journey from La Paz, who confessed that she had been a Virgin of the Sun.

[159] *Cronica Moralizada de la Provincia del Peru, del Orden de San Agustin, por el Padre Fray Antonio de la Calancha.* Lima, 1653.

[160] Mr. Merivale, in his *Colonization and Colonies*, says, "It must be admitted that, had the legislation of Spain in other respects been as well conceived as that respecting the Indians, the loss of her Western empire would have been an unmerited visitation."

[161] Others say that the word *Cacique* was brought from the Old World by the Spaniards, and that it is a corruption of the Arabic *Sheikh*.

[162] Prince of Esquilache's despatch, A.D. 1618, No. 6, p. 344, H. 53. MS. despatches in the national library at Madrid.

[163] See the sentence of death passed on the Inca Tupac Amaru in 1782, by the Visitador Areche, in which the use of these dresses, and the celebration of festivals and plays, are prohibited for the future.

[164] See *Money's Java*, i. p. 215, where there is an account of the position and functions of the native "Regents."

[165] The pay of an Indian was usually 1 rial (6*d.*) a week in the farms, and 20 rials (about 10*s.*) in the mines. But the miners kept back a third of the Indian's wages, nominally to form a fund to pay for his return to his home at the end of

his period of service.

[166] The Marquis of Montes Claros derives the word *mita* from the Quichua *mitta*, "time," and says that the *mita* was established to prevent idleness, and for the good of the Indians!—*Memorias*, i. p. 21.

[167] *Report of the Viceroy Prince of Esquilache*, 1620. This, however, is not quite clear: it is more probable that Indians were lawlessly torn from their homes to work in the mines when the *mita* of a seventh did not yield a sufficient number of labourers. In North Peru the proportion was a sixth, and in Quito a fifth.

[168] Montes Claros describes them as Indians domiciled on the estates or in the houses of Spaniards, like servants; their masters giving them food, clothes, and a bit of land, and paying their tribute for them. Lest the system should degenerate into slavery, the king, in a *cedula* of 1601, declared that they were free, and desired that this should be made known to them.—*Memorias*, i. p. 27.

[169] *Ordenanzas*, No. 34, 12, 140.

[170] Especially in those of the Count of Alba de Liste in 1660. In September of that year this viceroy assembled a Junta, in obedience to an order from Spain, to consult respecting the instruction and good treatment of the Indians. The proceedings, still in MS., may be seen in the national library at Lima.

[171] *Cuzco and Lima*, chap. vii., from the *Noticias Secretas* of the Ulloas.

[172] II. p. 304 of the *Memorias de los Vireyes*. But no safe calculation can be made respecting the actual population from these numbers.

[173] *Papeles Varios.* No. 4. MS. in the library at Lima.

[174] The amalgamation with quicksilver was introduced at Potosi by Velasco in 1571. The quicksilver was sent down from Huancavelica to the port of Chincha, thence to Arica by sea, and from Arica over the cordillera to Potosi.—*Report of the Prince of Esquilache.*

[175] *Carta sobre trabajos, agravios, y injusticias que padecen los Indios del Peru*; por Don Juan de Padilla, 1657.—MS. in the National Library at Lima.

[176] *Papeles Varios.* No. 4. MS.

[177] MS. in Lima library.

[178] *Manifesto de los agravios que padecen los Indios.*—MS. at Lima.

[179] *Funes*, iii. p. 242-333.

[180] *Calancha.*

[181] In 1591 a duty of 2 per cent. was placed on all merchandise, and 5 per cent. on coca.—*Report of the Prince of Esquilache*, 1620.

[182] This system of *repartimientos* or *repartos* was also introduced in the first instance with a benevolent intent, that of supplying the people with European goods at a reasonable price. I use the word *reparto* in future, to distinguish this system from that of the *repartimiento* during the earlier period of Spanish domination in Peru, which, with the same word, had a very different meaning.

[183] *Informe por Diego Tupac Amaru.—Azangaro.* Oct. 18, 1781. (Angelis).

[184] Letter from Gen. del Valle to two friends at Lima, Oct. 3, 1781.

[185] *Colonization and Colonies*, p. 6 and p. 283 (*note*).

[186] *Papeles Varios*, No. 4.—MS. at Lima.

[187] *Manifesto de Don Juan de Padilla.*—MS. at Lima.

[188] *Sumario del Concilio II., Provincial en Lima*, 1567. Also, letter from Dr. Juan Moscoso, Bishop of Cuzco, July 20, 1782, MS.; and in the collection of Angelis.

[189] *Practica de visitas y Residencias*, Naples, 1696; and *Papeles Varios*, No. 4.

[190] See Temple's *Travels in Peru* for an authentic account of the rebellion of the Cataris in Upper Peru, and the siege of La Paz.

[191] Report of the Cabildo of Cuzco, January, 1784, MS.; also in Nos. 9 to 20 of the *Museo Erudito* of Cuzco, July, 1837.

[192] Letter from Moscoso, Bishop of Cuzco, MS.

[193] *Ensayo de la Historia civil del Paraguay, Buenos Ayres, y Tucuman, por el Dr. Don Gregorio Funes, Dean de la Santa Iglesia Catedral de Cordova.*—Buenos Ayres, 1817, 4 vols, tom. iii. pp. 242-333. This work contains a detailed and very interesting account of the insurrections of Tupac Amaru, and of the Cataris in Upper Peru.

[194] An account of the copious materials from which my information respecting Tupac Amaru is derived will be found in a note at the beginning of the following chapter.

[195] "Native races must in every instance either perish, or be amalgamated with the general population of their country."—Merivale's *Colonies and Colonization*, p. 510.

[196] *Spanish Conquest in America*, iv. p. 368.

[197] *Colonies and Colonization*, p. 522.

[198] *Amaru* means serpent in Quichua, and *Tupac* royal or excellent. *Tupac* also may be the participle of *Tupani*, I rend.

Serpents are frequently carved in relief on the masonry of Inca edifices.

[199] These particulars are given by the monk Gonzalez, in his *Historia de lo acaecido en Paucartambo*, a narrative still in MS.; besides which, the materials for the history of the rebellion of Tupac Amaru consist of a large collection of original documents, including narratives, letters, despatches, and edicts, printed in the *Coleccion de obras y documentos relativos a la historia antiqua y moderna de las provincias de Rio de la Plata*, por Pedro de Angelis (Buenos Ayres, 1836), tom. v. pp. 109-286; the Report of the Cabildo of Cuzco, printed in the *Museo Erudito del Cuzco*; a large collection of original MSS. which were given to the late Gen. Miller in 1833, by Padre José Xavier de Guzman, of the Franciscan convent in Santiago de Chile; the letter from Tupac Amaru to Areche, and the sentence of death pronounced by Areche, which are printed in the Appendix to the Spanish edition of Gen. Miller's *Memoirs*; the work of Don Gregorio Funes, Dean of Cordova, published at Buenos Ayres in 1817 (4 vols.); and the diary of Don Sebastian de Segurola, Governor of La Paz, during its siege by the Indians, published in Temple's *Travels in Peru*, ii. p. 103-78. I also obtained a copy of Areche's reply to Tupac Amaru, from a MS. in the public library at Lima.

Weddell has given an account of the insurrection of Tupac Amaru in his *Voyage dans le Nord de Bolivie*, chap. xv. p. 263-88. This chapter is a résumé of the collection of original documents in the work of Angelis.

[200] Information from Don Pablo Astete, aged 80, given to Gen. Miller at Cuzco in 1835. Astete's father had been an intimate friend of Tupac Amaru, but afterwards served against him.

[201] Information from Dominga Bastidas, a cousin of Tupac Amaru's wife, given to Gen. Miller at Cuzco in 1835. She said that Micaela was always considered to have been very beautiful; and added, that the sons of Tupac Amaru, when at college at Cuzco, spent the feast-days at her house. In 1835 she was a very old woman.

[202] This description of Tupac Amaru is almost word for word as it was given to Gen. Miller by Don Pablo Astete, who well remembered him.

[203] The inhabitants of Tungasuca, about 500 in number, were as remarkable for their agricultural industry in 1853, when I saw them, as they formerly were as muleteers.

[204] From a MS. at Lima, headed "*En el Cuzco, Dec. 3, 1780.*"

[205] Inca Manco had two sons, Sayri Tupac and Tupac Amaru. Clara Beatriz Coya, daughter of Sayri Tupac, married Don Martin Garcia de Loyola, and had a daughter, Lorenza, created Marchioness of Oropesa and Countess of Alcanises, with remainder to the descendants of her great-uncle, Tupac Amaru. She married Don Juan Henriquez de

Borja, but, in 1770, there were no descendants of this marriage, and the descendant of Tupac Amaru was the lawful heir to the marquisate.

The decision of the Royal Audience of Lima disposes of the statement of Baron Humboldt (*Political Essay*, i. p. 208), that "the pretended Inca was a Mestizo, and his true father a monk." Humboldt was certainly misinformed, as there is not a shadow of grounds for the assertion. Tupac Amaru's birth is never questioned in any of the documents in my possession, consisting of his sentence of death, proclamations, and letters from his enemies, in which no opportunity is lost of blackening his memory.

[206] *Despachos que el Exmo. Señor Principe de Esquilache, Virey de los reynos del Peru, envio a su Magestad.* No. 6, p. 344. Lima, April 16, 1618.—MS. in the National Library at Madrid, H. 53.

[207] From the collection of Angelis.

[208] Funes.

[209] In my review of the language and literature of the Incas in a former work (*Cuzco and Lima*, chap. vi.) I gave some translated extracts from the drama of *Ollantay*, and an abstract of the plot. I then stated that it was an ancient play, which had been handed down from the time of the Incas; but I have since discovered that Dr. Valdez was its author, although it contains several ancient songs and speeches, and though the plot is undoubtedly ancient. I was led into the error by the opinion expressed by the Peruvian antiquary, Mariano Rivero,[210] a very high authority, that the drama had been handed down from the time of the Incas.

The original MS. is now in the possession of Don Narciso Cuentas, of Tinta, the nephew and heir of Dr. Valdez; but there are numerous MS. copies in Peru, and it has been printed at the end of Dr. Von Tschudi's *Kechua Sprache*.

There is a review of this Quichua drama of Dr. Valdez, in the *Museo Erudito* (Nos. 5 to 9), a periodical published at Cuzco in 1837, by the editor, Don José Palacios. He says that the story respecting Ollantay was handed down by immemorial tradition, but that the drama was written by Dr. Valdez. The writer criticizes the plot, objecting that the treason of Ollantay is rewarded, while the heroic conduct of Rumi-ñaui remains unnoticed. Palacios had inquired of Don Juan Hualpa, a noble Cacique of Belem in Cuzco, and of the Caciques of San Sebastian and San Blas, who agreed in their account of the tradition, which was that the rebellion of Ollantay arose from the abduction of an *Aclla* or Virgin of the Sun from her convent, but they had not heard her name, nor who she was.

These particulars respecting the origin of the drama of *Ollantay* may be interesting to readers who have paid any attention to the history of the civilization of the Incas. Though not so ancient as I once supposed, the drama is still very curious, because it contains songs and long passages of undoubted antiquity.

[210] Antiquedades Peruanas, p. 116.

[211] Two and a half leagues from Tinta, and two miles from Yanaoca.

[212] Near the port of Islay, and westward of Cornejo point, the coast forms a shallow bay, in which is the small cove of Aranta, 13 miles from the valley of Quilca. Its capabilities as a port were personally examined by the President Castilla three years ago.

[213] One mile from Tungasuca.

[214] A coat of arms was granted to the family of the Incas by Charles V., at Valladolid, in 1544. Tierce in fess. On a chief azure, a Sun with glory proper; on a fess vert an eagle displayed sable, between a rainbow and two serpents proper; on a base gules, a castle proper.

These partitions, by tiercing the shield, are not used in English heraldry.

[215] *Quispi*, flint; and *cancha*, a place.

[216] The Spaniards declared that the Indians set the church on fire, and that all perished.—(*Report of the Cabildo of Cuzco*, MS.) But the above account of the affair was given by the Inca himself to Don Miguel Andrade of Azangaro, and he denied positively that the church was set on fire.—*Sublevacion de Tupac Amaru.* Angelis.

[217] Landa, the Governor of Paucartambo, had formerly led an exploring expedition into the montaña, in search of the great river of Madre de Dios or Purus.—*Cuzco and Lima*, p. 263.

[218] This Cacique Sahuaraura was the father of the late Dr. Justo Sahuaraura, of Cuzco, who published a little genealogical work in Paris, in 1850, in which he claimed descent from the Incas. I hear, however, that his genealogy is apocryphal. In 1835 he wrote to the editor of the *Museo Erudito* of Cuzco, offering to write the traditions of his family in that periodical, as an Inca. A Dr. Gallego, of Cuzco, replied that no Inca was ever called Sahuaraura, but that the Inca Rocca once had a servant of that name, and that he might possibly be descended from him. This silenced Don Justo for a long time. (*Sahuay*, a flame; *raurac*, make. He had to light the Inca's fire).

[219] Letter from Dr. Moscoso, Bishop of Cuzco, July 20, 1782.—*Angelis.*

[220] In the collection of Angelis.

[221] *Angelis* and *Guzman*, MSS.

[222] *Historia de lo acaecido en el Real Asunto de Paucartambo, en la rebelion sucitada por José Gabriel Tupac Amaru.* A manuscript account of the siege of Paucartambo, by Fray Raymundo Gonzalez, Religioso Mercedario, written in 1782. The original is still at Paucartambo, where I saw it, and there are two or three copies at Cuzco.

[223] Namely:—

Pumacagua of Chinchero.
Rosas of Anta.
Sucacahua of Umachiri.
Huaranca of Santa Rosa.
Chuquihuanca of Azangaro.
Game of Paruro.
Espinosa of Catoca.
Carlos Visa of Achalla.
Chuquicallata of Saman.
Huambo Tupa of Yauri.
Callu of Sicuani.
Aronis of Checacupe.
Cotacellapa of Caravaya.
Sahuaraura of Oropesa.
Choquechua of Belem, in Cuzco.
Bustinza Uffucana of Sta. Anna, in Cuzco.—*Letter from Dr. Moscoso, Bishop of Cuzco.*

[224] The way in which this valuable despatch of the Inca Tupac Amaru became public is very curious. In 1806 Dr. Tadeo Garate, of La Paz, Secretary to Bishop Las Heras (afterwards Archbishop of Lima), was ordered by the Viceroy Marquis of Aviles to publish a history of the Rebellion of Tupac Amaru in 1780-1; and, to guard against the possibility of authentic counter-statements, this despatch was taken from the archives of Cuzco, and sent to La Paz in charge of an Indian student named Pasoscanki, who perused it on the road, and was so struck with the magnanimity and heroism of his native prince, that he did not deliver the papers. He afterwards emigrated to Buenos Ayres, and, in 1812, went to England, and commissioned Mr. Wood, of Poppin's-court, Fleet-street, to print Tupac Amaru's despatch; but, for want of funds, this was not done, and, Pasoscanki returning to Buenos Ayres, the publication was abandoned. In 1828 the same printer was employed to print the Spanish edition of Gen. Miller's *Memoirs*, and at that time the despatch was found amongst some old papers in Mr. Wood's office. It was finally published in an appendix to the Spanish edition of Gen. Miller's *Memoirs*.

[225] Report of Gen. del Valle, Sept. 30, 1781, MS. Letter of Areche. MS., in the library at Lima.

[226] This draft of an edict is amongst the papers in Angelis. It is possible, however, that it may have been forged by the Spaniards, in order to produce written evidence of the intentions of Tupac Amaru.

[227] Tomas Parvina de Colquemarca, "Justicia Mayor," and Felipe Bermudez, a Spaniard, belonged to the "Junta Privada," or Privy Council, of the Inca. Bermudez had acted as the Inca's secretary.

[228] There is said to be a picture in the church at Tinta representing this massacre.

[229] He is said to have been dressed in Incarial robes, with the arms of the Incas embroidered in gold at the corners.

[230] A list of the prisoners is given amongst the Angelis papers.

[231] It is printed in the appendix to the Spanish edition of Gen. Miller's *Memoirs*, vol. i.

[232] One account says that he was tortured until one arm was dislocated, by the *garruche*, by order of Matta Linares. *Guzman* MSS.

[233] Letter from Gen. del Valle, Sept. 30, 1781.

[234] One of these was Dr. Don Toribio Carrasco, afterwards Cura of Belem in Cuzco, who, in 1835, mentioned the circumstance, and the impression it had made, to Gen. Miller.

[235] These executions, in all their revolting details, were certified by Juan Bautista Gamarra, public notary to the Cabildo of Cuzco, in a document dated May 20, 1781.

[236] *Report of the Cabildo of Cuzco.*

[237] The edict, fixing the destinations of the different parts of each victim, is printed amongst the papers in Angelis.

[238] The Pizarros and their companions were angels of mercy when compared with such vile wretches as Areche and Matta Linares; yet we are told by one of his flatterers that "the tender heart of the visitador was filled with piety and humanity, and that early on the day after the execution he went to the cathedral, and, having confessed and partaken of the sacrament, he paid for several masses for the souls of the culprits, and heard them all on his knees, thus edifying the whole city." Hypocritical hyæna!—*Guzman* MSS.

[239] When Señor Zea, of Bogota, was in Paris, Kotzebue undertook a journey on purpose to obtain information from him respecting Tupac Amaru, having conceived the idea of writing a tragedy founded on his rebellion. But Zea, being a Colombian, knew little or nothing about it.

Kotzebue, however, continued his inquiries respecting Peru, which resulted in his play *The Virgins of the Sun*, and hence Sheridan's *Pizarro*.

[240] Orellana was a native of Cuenca, and descended from the great navigator of the Amazons.

[241] *Relacion del Gobernador de Puno, de sus expediciones, sitios, defensa, y varios acaecimientos, hasta que despoblo la villa de orden del Inspector y Commandante General Don José Antonio del Valle: corre desde 16 Noviembre 1780, hasta 17 de Julio 1781.*

[242] During my stay at Puno I lived in the house which was occupied by Orellana during the siege. It is now the property of Don Manuel Costas.

[243] Information from Gen. San Roman.

[244] One thousand nine hundred and fifty men deserted in six days.—*Letter from del Valle.*

[245] *Manifesto del Gen. del Valle. Se queja amargamente contra el visitador Areche.* Cuzco, Septre. 1781.—*Guzman* MSS.

[246] Information from Don Luis Quiñones of Azangaro.

[247] Angelis.

[248] Custom-house officers.

[249] *Informe por Don Diego Tupac Amaru.* Azangaro, Oct. 18, 1781.

[250] Angelis.

[251] By far the best account of the rebellion of the Cataris in Upper Peru, and of the two sieges of La Paz, is to be found in the work of Dean Funes.

[252] The Bishop of Cuzco, Dr. Don Juan Manuel Moscoso y Peralta, afterwards had twenty-two accusations or charges brought against him connected with this rebellion, which he answered in detail in a work published at Madrid. One is that he excommunicated a priest for betraying the secrets of the Indians told under the seal of confession;

another that he tried to save the lives of several Indian rebels; another that he asked for a general pardon after the death of the Inca; another that he permitted Mariano Tupac Amaru to celebrate the funeral of his father, &c. If these accusations were true, they all redound to the bishop's honour; and it is to be regretted that he was so anxious to defend himself against them. At the end of his book there are some letters to him from Diego Tupac Amaru. "*Inocencia justificada contra los artificios de la calumnia. Papel que escribio en defensa de su honor y distinguidos servicios hechos con motivo de la rebelion del Reyno del Peru, por José Gabriel Tupac Amaru: el Illustrissimo Señor Don Juan Manuel Moscoso y Peralta, Obispo del Cuzco.*" (Fol. Madrid).

[253] *Oficio del Inspector Don José del Valle, al Virey de Buenos Ayres.* Ayaviri, July 14, 1782.

[254] Report of the Cabildo of Cuzco.

[255] Report of Don Augustin de Jauregui, Viceroy of Peru. Lima, March 29, 1783.

[256] *Oficio de Don Gabriel de Aviles, a Don Sebastian de Segurola.* Cuzco.

[257] *Sentencia contra el reo Tupac Amaru, y demas acomplices, pronunciada por Don Gabriel de Aviles, y Don Benito de la Matta Linares.* July, 1783.

[258] Information from Don Luis Quiñones of Azangaro. Dr. Valdez died in 1816. Don Pablo Pimentel, the worthy Subprefect of Caravaya, told me that he remembered the old cura well, as a tall man with a stately walk, who always gave him a dollar when he met him in Sicuani.

[259] A fabulous region supposed to exist far to the eastward of the Andes, in the unknown parts of the Amazonian valley.

[260] *Oficio de Don Felipe Carrera, Corregidor de Parinacochas*, Julio 12, 1783. Also *Sentencia dado por el Virey de Lima, contra los reos*, Julio, 1783. Angelis.

[261] A person calling himself Juan Bautista Tupac Amaru, and professing to have been one of the sufferers, printed a pamphlet, which was deposited in the archives of Buenos Ayres. In it he relates the tale of his miseries in uncouth Spanish. He says that he beheld his fettered mother perish of thirst on the road to Lima, in presence of guards who turned a deaf ear to her cries for water. He saw his faithful wife die on board the ship, without being allowed length of chain enough to approach her. During an imprisonment of forty years at Ceuta the sentries never relaxed their cruelties until the ministry which came into power in Spain, after the military movement of 1820, set the few survivors at liberty.

It is now confidently asserted that the author of this pamphlet was an impostor. He came to Buenos Ayres in 1822, and the republican government granted him a house, and a pension for life of 30 dollars a month.

[262] The words of the Cura of Belem, who heard it.

[263] Don Luis Ocampo related this anecdote to Gen. Miller in 1835, when he was still living at Cuzco, but upwards of eighty years of age. After Peru had become independent, in about 1828, a person, calling himself Fernando Tupac Amaru, appeared in Buenos Ayres, and went on to Lima, becoming a monk in the convent of San Pedro; but he is believed to have been an impostor.

[264] Goyeneche was created Count of Huaqui. His brother, the late Bishop of Arequipa, and present Archbishop of Lima, is probably the senior Bishop of Christendom, dating his appointment from 1809; and he is certainly the richest man in all South America.

[265] *Confesion de Pumacagua.*

[266] Information from Gen. San Roman, who called them *Fresaderos*.

[267] *Diario de la expedicion del Mariscal de Campo Don Juan Ramirez, sobre las provincias interiores de la Paz, Puno, Arequipa, y Cuzco, por Don José Alcon, Teniente Coronel agregado a la misma expedicion.* Lima, 1815. (1 tom. 4°, 112 paginas).

[268] Information from Gen. San Roman, whose father, a native of Puno, joined Pumacagua at Cavanilla.

[269] Colonel Alcon.

[270] Gen. San Roman.

[271] *Documento*, i. *Oficio de Vicente Angulo a Ramirez.* Feb. 28, 1815.

[272] *Documento* ii. *Oficio de Pumacagua a Ramirez.* Marzo 6, 1815.

[273] *Documento* iii. *Contestacion de Ramirez a Pumacagua.* Marzo 7, 1815.

[274] Information from Gen. San Roman.

[275] Gen. San Roman, who gave me the account of this battle, was himself present at it, with his father, when a very little boy. His father was afterwards shot in the plaza of Puno, by the Spaniards, and when the liberating army arrived on the coast of Peru, in 1822, the young San Roman hurried down from his mountain home to join their ranks.

[276] In October, 1823, Gen. Miller saw the fair object of the poet Melgar's adoration, at Camana, on the coast of Peru. She was a native of Arequipa, with light hair, blue eyes, and a fair clear complexion. She refused Melgar, married another, and, being obliged to flee with her husband to escape the persecution of the Royalists, found an asylum on the banks of the river Camana. Her maiden name was Paredes.—Miller's *Memoirs*, ii. p. 90.

Melgar's brother is now Minister of Foreign Affairs at Lima.

[277] Information from Don Luis Quiñones of Azangaro.

[278] So strong is the feeling of the Peruvian people generally against this oppressive system, that, in the reformed constitution promulgated on Nov. 25, 1860, forced recruiting was declared to be a crime.

"El reclutamiento es un crimen."—*Titulo* xvi., *art.* 123.

[279] In 1859 there was a very formidable rising of the Indians in Chayanta, which was not put down until after much bloodshed.

[280] Humboldt.

[281] Hatun-colla was once the capital of the great Inca province of the Collao.

[282] The three latter are also mentioned by Haenke.

[283] *Antiquedades Peruanas.*

[284] One of the manufacturers, Don Manuel Zenon Ramos, has been very active in seeking for instruction, designs, and models from Europe.

[285] *Lupinus Paniculatus.*—Chloris Andina, ii. p. 252.

[286] Landa sent in a report of his expedition to the Corregidor of Cuzco. My friend Dr. Don Julian Ochoa, the rector of the university of Cuzco, has recently searched the archives of the ancient municipality of that city, as well as private collections, for this interesting document, at my request, but without success.

[287] See *Cuzco and Lima*, chap. viii.; also *Roy. Geo. Soc. Journal* for 1855.

[288] This is not the great river which flows near Cuzco, and falls into the Ucayali. The Indians call all rivers which serve as the trunk or centre of a system of streams *Huilca* or *Vilca-mayu*.

[289] Brother of the present rector of the university of Cuzco.

[290] Account of the Valleys of Marcapata, by Don José Maria Pacheco. *Museo Erudito del Cuzco*, 1839, No. 21. See also an account of a journey down the course of the river Marcapata as far as its junction with the Ollachea, signed Paul Marcoy, in the *Revue Contemporaine*, tom. 4me, 1860. *Scènes et Paysages dans les Andes.*

[291] *Comm. Real*, ii. lib. iii. cap. xix. p. 174.

[292] Lib. iv. cap. iv.

[293] Don Pablo Pimentel says that the ancient name of the province was *Inahuaya*.

[294] *Bosquejo del estado actual de la provincia de Carabaya, y majorias que proponen al Supremo Gobierno el Suprefecto de ella, Don Pablo Pimentel.* Arequipa, 1846.

[295] *Memorias de los Vireyeo*, i. p. 36.

[296] *Memorial de cosas tocantes las minas de Caravaya.* J. 58, p. 441. A very illegible manuscript in the national library at Madrid.

[297] *Relacion del Conde de Castellar*, p. 222.

[298] *Relacion del Obispo Melchor Liñan y Cisneros*, p. 299.

[299] This appears from the *Informe* of Diego Tupac Amaru, dated Azangaro, Oct. 18, 1781; in which he stipulates that the coca estate near San Gavan, in Caravaya, shall be granted to Mariano Tupac Amaru as his rightful possession, because it belonged to his father the Inca.

[300] *Bosquejo*, &c.

[301] There is one other town, or rather wretched village, on this Arctic plain, within Caravaya, called Macusani, about 30 miles north-west of Crucero.

[302] A Quichua poem was written on the Cura Cabrera, and his breed of paco-vicuñas, by Don M. M. Basagoitia. *Rivero's Antiq. Per.* 112-13.

[303] According to Don Pablo Pimentel. The people of Sandia told me 45,000 cestos, or 900,000 lbs.; and Lieut. Gibbon, U.S.N., in his work, says 500,000 lbs.

[304] These Chunchos of Caravaya belong to the same tribe as the fierce Indians of the Paucartambo valleys, for some account of whom see my former work, *Cuzco and Lima*, p. 272.

Don Pablo Pimentel calls the wild tribes of Caravaya *Caranques* and *Sumahuanes*, but I think this is a mistake. Garcilasso de la Vega mentions the *Coranques* as a fierce tribe to the north of Quito, who were conquered by the Inca Huayna Capac.—*Comm. Real*, i. lib. viii. cap. vii. p. 274.

[305] *Challhua*, fish, in Quichua; and *uma*, water, in Aymara.

[306] *Lijera descripcion que hace Juan Bustamante, de su viaje a Carabaya, y del estado actual de sus lavaderos y minerales.* Arequipa, 1850. Bustamante says that, at the time of his visit, there were a hundred people at the *lavaderos* of the Challuma, and that the Indians received 4 rials a day.

[307] *On the Geology of Bolivia and Southern Peru*, by David Forbes, Esq., in the Journal of the Geological Society for Feb. 1861, p. 53.

Mr. Forbes had, of course, personally examined only a portion of this great Silurian region. At Tipuani, in Bolivia, there is a very rich auriferous country, composed of blue-clay slates, with no fossils; while the beds near Sorata contain fossils, and consist of blue-clay shales, micaceous slates, grauwacke, and clay slates, with gold-bearing quartz, metallic bismuths, iron-ore, and argentiferous galena. "The whole of this Silurian formation is eminently auriferous, and contains everywhere frequent veins of auriferous quartz, usually associated with iron pyrites."

[308] The thermometer was at 25° Fahr. inside the hut.

[309] Observations by Negretti and Zambra's boiling-point thermometer.

[310] Titulo 14, s. 104.

[311] The *Juntas Departmentales* have since been abolished by the Reformed Constitution, promulgated in Nov. 1860. Up to May, 1860, Gen. Castilla, the President, had never permitted them to meet.

[312] Titulo 15, s. 114.

[313] *La Revista de Lima*, tom. i. p. 159-60. Nov. 15, 1859. An article by G. A. Flores.

[314] The same was once the case all over Peru, in the good old days of the Incas, as we know from the curious dying confession of the last of the conquerors, Marcio Serra de Lejesama, addressed to Philip II., A.D. 1589.

"Your Majesty must understand that my reason for making this statement is to relieve my conscience, for we have destroyed the government of this people by our bad example. Crimes were once so little known among them, that an Indian with 100,000 pieces of gold and silver in his house left it open, only placing a little stick across the door, as a sign

that the master was out; and nobody went in. But when they saw that we placed locks in our doors, they understood that it was from fear of theft; and when they saw that we had thieves amongst us, they thought little of us; but now these natives, through our bad example, have come to such a pass that no crime is unknown to them."—*Calancha*, lib. i. cap. 15, p. 98.

[315] G. de la Vega, *Com. Real.* i. lib. viii. cap. 15.

[316] *Acosta*, lib. iv. cap. 22, who cannot agree with those who believe its reputed virtues to be the effects of imagination.

[317] *Cedula*, 18 Oct. 1569.

[318] *Solorzano*, *Polit. Ind.*, lib. ii. cap. 10, quoted by Unanue.

[319] J. de Jussieu was the first botanist who sent specimens of coca to Europe, in 1750.

Dr. Weddell suggests that the word comes from the Aymara *khoka*, a tree, i. e. *the* tree *par excellence*, like *yerba*, *the* plant of Paraguay. The Inca historian Garcilasso, however, spells the word *cuca*.

[320] The cesto of coca sells at 8 dollars in Sandia. In Huanuco it is 5 dollars the arroba of 25 lbs.

[321] Report of the Prince of Esquilache.

[322] Poeppig calculates the yield of Huanuco at 500,000 lbs.

[323] Poeppig, *Reise*, ii. p. 252; also Van Tschudi, p. 455.

[324] In Caravaya the *llipta* is made into a pointed lump, and kept in a horn, or sometimes in a silver receptacle, in the *chuspa*. With it there is also a pointed instrument, with which the *llipta* is scratched, and the powder is applied to the pellet of coca-leaves. In some provinces they keep a small calabash full of lime in their *chuspas*, called *iscupurus*.

[325] *Bonplandia*, viii. p. 355-78.

[326] The information in this chapter is derived from personal observation; from the essay on coca by Dr. Don Hipolito Unanue, in Nos. 3 to 8 of the *Museo Erudito*; and from the works treating of coca, by Van Tschudi, *Travels in Peru*, p. 455; Dr. Poeppig, *Reise in Peru*, ii. p. 248; Dr. Weddell, *Voyage dans le Nord de Bolivie*, p. 516; the *Bonplandia*; and a memorandum by Dr. Booth, of La Paz. These are the best authorities on the subject.

[327] Dr. Weddell, the discoverer of this species, had never seen it in flower. I brought home leaves, flowers, and fruit of the *C. Caravayensis*, which are now in the herbarium at Kew.

[328] An Umbellifer. The roots taste something like a parsnip, and there are four kinds—white, yellow, brown, and reddish.

[329] *Lenco* appears to mean "sticky mud," and *huayccu* is a ravine, in Quichua.

[330] *Com. Real.* i. lib. viii. cap. 15.

[331] Lib. iv. cap. 29.

[332] Not, of course, the famous gold-bearing river of the same name.

[333] *Carhua-carhua-blanca (Lasionema ?) Tree.*—30 or 40 feet high, growing in moist parts of the valley of Tambopata.

Leaves.—Opposite, entire, petiolate, oblong, acute, smooth on both sides, dark green above, lighter beneath, with veins and midrib nearly white. 2½ feet long by 9 or 10 inches broad. Coarse, bulging, and wrinkled between the veins.

Calyx.—Deep purple and green, leathery, 5-toothed, teeth rounded.

Corolla.—Tube white, tinged with light purple, leathery, 5 laciniæ, smooth and reflexed.

Stamens.—5, attached to the middle of the tube of the corolla, exserted. Filaments pillose at the base, tinged with purple. Anthers a little shorter than the filaments, all lying on the lower sides of the tube of the corolla, light brown.

Style.—Exserted, but a little shorter than the stamens, light green colour. *Stigma*, bi-cleft.

Panicles.—Corymbose and multiflor, in threes, 6 to 15 buds on each. *Pedicels* a brownish purple.

I have attempted to describe this tree, because I have been unable to identify it with any of the chinchonaceous plants in Dr. Weddell's work.

[334] *Yana*, in Quichua, is black; and *mayu* a river.

[335] *Rupicola Peruviana* (family of *Ampelidæ*). Van Tschudi says that they feed on the seeds of chinchona-trees.—*Travels in Peru*, p. 427.

[336] The bark, leaves, and capsules from this tree are deposited in the herbarium and museum at Kew.

[337] I brought home a bunch of the capsules, now in the herbarium at Kew.

[338] There we also found the *Trichomanes muscoides*, a pretty little fern which, I am informed by Mr. J. Smith, of Kew, though common in the West Indies, was not previously known to be a native of Peru.

[339] Specimens from this locality were examined and reported upon at 28, Jermyn-street.

[340] Described by Dr. Weddell, in his *Histoire Naturelle des Quinquinas*, in a note under the genus *Pimentelia*.

[341] In Peru the father of a child is *compadre* to its godfather. It is considered a very close and sacred relationship.

[342] Hence the name *Lenco-huayccu*. *Lenqui* is anything sticky in Quichua, and *huayccu* a ravine.

[343] *Quarterly Journal of the Geological Society*, Feb. 1, 1860, p. 59.

[344] Dr. Weddell believes it to be a distinct species from the *C. Micrantha* of Huanuco, and has named it *C. Affinis*.

[345] "*Alcalde Municipal del Distrito de Quiaca, al Señor Juez de Paz Don Juan de la Cruz Gironda.*

"6 de Mayo de 1860.

"Teniendo positivas noticias de que sea internado a los puntos de Tambopata un estranjero Ingles, con objeto de estraer plantas de cascarilla, me es de absoluta necesidad pasarle a vm esta nota, para que sin permitir que en grave perjuicio de los hijos del pais, lo tome ni una planta, por lo que como autoridad debe vm de aberiguar bien para capturar a el y al persona quien se propone a facilitarle dichas plantas, y conducirlos a este.

"Dios guarde a vm.,
"José Mariano Bobadilla."

[346] Hence the name of the Peruvian province of *Parinacochas*. *Parihuana-cocha*, the Flamingo lake.—G. de la Vega, *Comm. Real.* i. lib. iii. cap. ix. p. 83.

[347] "We give here the notices which we have collected respecting the existence and position of a lake which is not to be found in any map, and which bears the name of Arapa. It is said to be 6 leagues to the north of lake Titicaca, and is 30 leagues in circumference. It extends from the foot of a very abrupt chain of mountains, and its figure is that of a half-moon. It contains some islands. Its waters, having traversed two other smaller lakes to the west, fall into the Ramiz, which is thus rendered navigable at all seasons. The principal villages around the lake of Arapa are Chacamana, Chupan, Arapa, and Vetansas. Round the latter place it is said that there are many veins of silver and mines of precious stones."—*Castelnau*, tom. iii. chap. xxxix. p. 420.

[348] *Taya* is an Aymara word, meaning "cold."

[349] *La Balsa de Arequipa*, Junio 15.

"Las cuestiones municipales han hecho gran daño al puerto de Islay, pues todo va mal con el desacuerdo que reina entre el cuerpo y las demas autoridades que lo combaten escandalosamente.

"Quiero que se sepa en esa ciudad que los estranjeros han dado en esportar per esta plantas de cascarilla, que es sabido esta prohibido hacerlo: acaba de embarcar un Ingles una multitud de ellas para la India, por comision official de su Gobierno. Yo no sé como es que esto se tolera, defraudando asi uno de los mejores y mas esclusivos ramos de nuestra riqueza."

[350]

"*Ministerio de Hacienda y Comercio.*
"*Lima, Junio 20 de 1860.*

"En el expediente relativa a la medida tomada por el Administrador de la Aduana de Islay, impediendo la extraccion de cierto numero de plantas de cascarilla, ha recaido con fecha de hoy, el siguiente decreto.

"Visto este expediente, y atendiendo a que no esta prohibida por reglamento de Comercio, la extraccion de plantas de cascarilla, y a que de impedirse su exportacion, con detrimento de la libertad comercial que las leyes de la Republica, y ese reglamento protejan, no se conseguiria en manera alguna el objeto que el Administrador de la Aduana se ha propuesto al impedir el embarque de varias plantas de esa especie, se desaprueba dicha prohibicion, sin que por este se entiende que el Gobierno deja de apreciar el celo y patriotismo que revela en el preindicado Administrador la enunciada medida.

"Dios guarda a V. S.,
"JUAN JOSÉ SALCEDO."

[351] In an Appendix will be found a list of these knights errant in the cause of liberty. It was one of the last things upon which that gallant old warrior, General Miller, the most distinguished of their number, was engaged before his death in November 1861.

[352] "Pos las narraciones tan calumniosas como absurdas de algunos aventureros maldicientes, se nos considera punto menos que salvages," says a Peruvian writer.

[353] In Spanish times there were 83 "titulos de Castilla" in Peru, consisting of 1 duke, 46 marquises, 35 counts, and 1 viscount. The descendants of several of these noblemen still reside on their estates in Peru.

[354] The boundary between Ecuador and Peru is now founded on the *uti possidetis* of 1810, and the treaty of 1829.

[355] *Pruvonena*, i. p. 688.

[356] Pedro Castilla discovered the class of ore called *lecheador* (chloro-bromide of silver). See Bollaert's *Antiquarian and other Researches in Peru*, &c. In this work there is a full and interesting account of the province of Tarapaca, and of the nitrate of soda works, and other mineral products of that part of Peru.

[357] This province also yields great quantities of tobacco, sugar, rice, and maize; and the adjoining province of Truxillo produces cochineal, which was introduced by Mr. Blackwood.

[358] 1 *fanegada* = 41,472 square *varas* (yards), and 1 acre = 4840 varas. In Arequipa the square measure is called a *topu*. 1 *topu* = 5000 square *varas*.

[359] Mr. Gerard Garland is about to commence a cotton plantation in the littoral province of Payta; and, if his project succeeds, it will doubtless induce others to follow his example.—*Cotton Supply Reporter*, March 15th, 1862.

[360] The use of guano as a manure was well known to the ancient Peruvians long before the Spanish conquest. Garcilasso de la Vega, the historian of the Incas, thus describes the use made by them of the deposits of guano on the coast of Peru:—

"On the shores of the sea, from below Arequipa to Tarapaca, which is more than 200 leagues of coast, they use no other manure than that of sea-birds, which abound in all the coasts of Peru, and go in such great flocks that it would be incredible to one who had not seen them. They breed on certain uninhabited islands which are on that coast; and the manure which they deposit is in such quantities that it would also seem incredible. From afar the heaps of manure appear like the peaks of some snowy mountain range. In the time of the kings, who were Incas, such care was taken to guard these birds in the breeding season, that it was not lawful for any one to land on the isles, on pain of death, that the birds might not be frightened, nor driven from their nests. Neither was it lawful to kill them at any time, either on the islands or elsewhere, also on pain of death. Each island was, by order of the Incas, set apart for the use of a particular province, and the guano was fairly divided, each village receiving a due portion. Now in these times it is wasted after a different fashion. There is much fertility in this bird-manure."—II. lib. v. cap. iii. p. 134-5. (Madrid, 1723.)

Frezier mentions that, when he was on the coast in 1713, guano was brought from Iquique and other ports along the coast, and landed at Arica and Ylo, for the aji-pepper and other crops.—Frezier's *South Sea*, p. 152. (London, 1717.)

[361] *Informes sobre la existencia de Huano, en las Islas de Chincha, por la comision nombrada por el Gobierno Peruano*, 1854. A small pamphlet, with plans.

[362] Bollaert's *Account of Tarapaca*.

[363] In 1858 there were 52 ships loading at the Kooria Mooria islands, off the coast of Arabia. In Jibleea the guano is found coating nearly the whole of the island (about 500,000 tons), white and polished, so as to be very slippery, which is very different from the guano of Peru. In May, 1857, this guano from Jibleea island was analyzed at Bombay by Dr. Giraud, with the following result:—

Water	6·88
Azotized matter, with ammoniacal salts	38·75
Fixed alkaline salts	6·00
Sand	26·25
Sulphate of lime	3·77
Phosphate of lime	18·35
	100·00

Thus the quantity of phosphate of lime is very small, and it appears that the rains have washed it down, and that it has formed a stalactitic deposit on the surface of the rock beneath the guano. A cargo of this deposit was shipped and sold at Liverpool for 8*l.* a ton.

The composition of Peruvian guano is as follows:—

Water	13·73
Organic matter and ammoniacal salts	53·16
Phosphates	23·48
Alkaline salts	7·97
Sand	1·66
	100.00

Of Ichaboe guano:—

Water	24·21
Organic matter, and ammoniacal salts	39·30
Phosphates	30·00
Alkaline salts	4·19
Sand	2·30
	100·00

[364] The Peruvian Government contracted three loans in London between 1822 and 1825, amounting to 1,816,000*l.*, bearing interest at 6 per cent.

No interest was paid from 1825 to 1849, when the sales of guano had greatly increased the resources of Peru. In 1849 Señor Osma made an agreement with the bondholders to issue New Bonds at 4 per cent. per annum, the rate to increase ½ per cent. annually up to 6 per cent. Arrears of interest, about 2,615,000*l.*, were to be capitalized, and Deferred Bonds to be issued to represent 75 per cent. of these arrears, and to bear interest at 1 per cent. per annum, increasing ½ per cent. annually up to 3 per cent.

In 1852 the Congress authorised General Mendiburu to effect a loan in London for 2,600,000*l.* to redeem the remainder of the 6 per cent. loan, and to refund other home and Chile debts.

The annual interest and sinking fund amount, respectively, to 267,000*l.* and 82,000*l.*; the payment of which is secured on the profits of guano sold in Great Britain.

There is also a French loan of 800,000*l.* secured on the profits of guano sold in France.

The whole foreign debt of Peru amounted to 4,491,042*l.* in 1857; and the domestic debt to 4,835,708*l.* The foreign debt is annually reduced by means of a sinking fund.

[365] *Memorias de los Vireyes que han gobernado el Peru.* (Lima, 1859.)

[366] After his death 22 wounds were found on his body, and 2 bullets lodged.

[367] Mr. Howard has recently obtained 8·5 per cent. of alkaloids from a specimen of red bark.

[368] There is no ascertained law by which many of the species of the chinchona genus are thus limited to narrow zones as regards latitude. Mr. Spruce mentions that on the lower regions of the Andes of Pasto and Popayan, in New Granada, there are the conditions of climate and altitude requisite for the growth of *C. succirubra*, but it has not been found there.

[369] This is not the same as the *pata de gallinazo* of Huanuco, which has been named by Mr. Howard *C. Peruviana*.

[370] Mr. Cross sowed eight of the seeds; one began to germinate on the fourth day, and at the end of a fortnight four seeds had pushed their radicles. In three weeks one had the seed-leaves completely developed; and on the twenty-eighth day after sowing, the last of the eight pushed its radicle. Eight chinchona-seeds, gathered by Mr. Spruce in 1859, were sown at Guayaquil, which had remained nine months in his herbarium. Of these four germinated, which clearly shows that well-ripened and properly-dried seeds do not lose their vitality for a much longer period than their excessive delicacy would lead one to suspect.

[371] 1. *Notes of a visit to the Chinchona Forests*, by R. Spruce, Esq., printed by the Linnæan Society, vol. iv. of their *Proceedings*.

2. Mr. Spruce's *Report to the Under Secretary of State for India*, Oct. 12, 1860.

3. *Report of the Expedition to procure Plants and Seeds of the Chinchona succirubra*, by R. Spruce, Esq., Sept. 22, 1861.

[372] Letter from Mr. Pritchett to the Under Secretary of State for India, dated July 9, 1861.

[373] Letter from Mr. Pritchett to the Under Secretary of State for India, dated Dec. 13, 1860.

[374] Smyth's *Journey from Lima to Para*, p. 63.

[375] Herndon's *Valley of the Amazon*, p. 126.

[376] Herndon's *Valley of the Amazon*, p. 136.

[377] Smyth, p. 115; who says that, according to a register which had been kept there, it rains at Casapi on more than half the days of the year.

"From May to November the sun shines very powerfully in the valley of Chinchao, and consequently the soil, when it is cleared of wood, becomes so parched that its surface opens in chinks, but underneath it always preserves humidity, and therefore needs no irrigation. From November to May it rains much, sometimes six or seven days without intermission."—Dr. A. Smith's *Peru as It Is*, ii. p. 57.

[378] Of the identity of the species collected by Mr. Pritchett there is no doubt. He brought home specimens from the trees whence the seeds were obtained, which have been examined by Mr. Howard, and proved to belong to *C. nitida*, *C. micrantha*, and *C. Peruviana*. The barks also have been found to contain a satisfactory percentage of alkaloids. Some further particulars respecting these species have already been given in chap. ii. p. 30-35.

[379] Pavon gives its height at from 18 to 24 feet, and 8 to 9 inches in diameter.

[380] They yield the *crown bark* of commerce.

[381] Seemann's *Voyage of H. M. S. Herald*, i. p. 177. For some further particulars respecting the chinchona region of Loxa, see chap. ii. p. 21-25.

[382] *Nueva Quinologia de Pavon. C. Chahuarguera* and *C. crispa*.

[383] Mr. Cross transmitted the following dried specimens of the parts of chinchona-trees from Loxa:—

1. Very characteristic specimens of the bark, leaves, flowers, and capsules of *C. Condaminea* (*C. Chahuarguera*, Pavon). This kind yields the rusty crown bark of commerce.

2. Bark, leaves, and flowers of *C. crispa*, Tafalla, a kind which is included in the *C. Condaminea*, H. and B. It yields the *quina fina de Loxa*, or *cascarilla crespilla*.

3. Bark and leaves of *C. Lucumæfolia* of Pavon, from Zamora. This is the *cascarilla de hoja de lucma* of the natives. Mr. Cross made no attempt to collect the seeds, as this species is comparatively worthless.

[384] My collection of dried specimens is deposited in the museum and herbarium at Kew. It consists of leaves, flowers, fruit, and bark of *C. Calisaya*; leaves and flowers of *C. micrantha*; leaves and fruit of *C. Caravayensis*; fruit of *Pimentelia glomerata*; and bark from the branches of almost every species of chinchona and allied genera in the Caravayan forests.

Mr. Spruce's collection of all the parts of *C. succirubra* is in the herbarium at Kew.

Mr. Pritchett's collection of leaves, fruit, and bark of *C. nitida*, *C. micrantha*, *C. Peruviana*, and *C. obovata*, is in the possession of Mr. Howard.

Mr. Cross's dried specimens of leaves, flowers, fruit, and bark of *C. Condaminea* (*C. Chahuarguera* of Pavon), bark, leaves, and flowers of *C. crispa* of Tafalla, and bark and leaves of *C. Lucumæfolia*, are partly in my possession, partly in that of Mr. Howard, and partly in that of Mr. Veitch.

[385] Six cases of chinchona-plants from this depôt were despatched to Ceylon by the mail of March 4, 1862.

[386] See Fortune's *Tea Districts*, chap. xxi. p. 358-9.

[387] Mr. Cross says that Wardian cases, as they are at present constructed, are notoriously unfit for the growth of plants of any description. He adds that the plants must be healthy root and top before they are deposited in the cases. They ought to be exposed for at least a month to the full action of the sun and atmosphere, so that the juices, stems, and leaves may be fully developed and matured. Plants taken out of hothouses, or from dense forests, are not in a fit state to be sent away immediately in Wardian cases. They are then "blanched," and are easily affected by adverse influences, such as excess of moisture or drought.

[388] In October, 1861, the *Schinus molle* plants were 3 feet high; and the chirimoyas 15 inches. Plants of both have been sent to the gardens at Bangalore.

[389] Seemann's *Voyage of the Herald*, i. p. 171.

[390] These 11 classes are:—1. The *Kirüm Nairs*, who are agriculturists, clerks, and accountants, and do the cooking on all public occasions, a sure sign of transcendent rank. 2. The *Sudra Nairs*. 3. The *Charnadus*. 4. The *Villiums*, who are palkee-bearers to Namburis and Rajahs. 5. The *Wattacotas*, or oil-makers. 6. The *Atticourchis*, or cultivators. 7. The *Wallacutras*, or barbers. 8. The *Wallateratas*, or washermen. 9. The *Tunars*, or tailors. 10. The *Andoras*, or pot-makers. 11. The *Taragons*, or weavers, who are very low in the scale, for even a potter must purify himself if he chances to touch a weaver.—Buchanan, ii. p. 408.

[391] Buchanan.

[392] Temulporum and Palghaut.

[393] They range from 12 to 60 reas, or 6 pies to 2 annas 5 pies per tree.

[394] The value of the exported nuts, kernels, oil, and coir of the cocoanuts in 1859, was 157,995*l.*

[395] Drury's *Useful Plants of India*.

[396] The best soil for ginger-cultivation is red earth free from gravel. At the commencement of the monsoon beds of 10 or 12 feet by 3 or 4 are formed, in which holes are dug a foot apart, which are filled with manure. The roots, hitherto carefully buried under sheds, are dug out, chipped into suitable sizes for planting (1½ to 2 inches long), and buried in the holes. The bed is then covered with a thick layer of green leaves, which serve as manure, while they keep the beds from too much dampness. Rain is requisite, but the beds must be kept from inundation, and drains are therefore cut between them. The roots or rhizomes, when old, are scalded, scraped, and dried, and thus form the white ginger of commerce.—Drury's *Useful Plants of India*.

[397] The tallipot or fan-palm (*Corypha umbraculifera*) has a stem 60 or 70 feet high, crowned with enormous fan-shaped leaves, with 40 or 50 pairs of segments. These fronds, when dried, are very strong, and are used for hats and umbrellas. The petiole is seven feet long, and the blade six feet long and thirteen feet broad.

[398] The sumach-tree (*Cæsalpinia coriaria*) was introduced into India from America, by Dr. Wallich, in 1842. The pods are much used for tanning purposes.

[399] *Nil*, blue, and *giri*, a mountain; from the blue *Justitias* which cover many of the hill-slopes.

[400] *Report of Captain J. Ouchterlony, Superintendent of the Neilgherry Survey in 1848.*

[401] Ferdosi.

[402] Dr. Wight says that this plant might be collected in vast quantities with little trouble or expense, and yields an excellent red dye.

[403] This nettle is frequent all over the higher ranges of the Neilgherries. The bark yields a fine strong fibre, which the natives obtain by first boiling the whole plant, to deprive it of its virulently-stinging properties, and then peeling the stalks. The textile material thus obtained is of great delicacy and strength.—Wight's *Spicelegium Neilgherense*. The fibre of the Neilgherry nettle is worth 200*l.* a ton in England, and its cultivation is likely to be a remunerative speculation.

[404] *Tribes inhabiting the Neilgherry Hills, from the rough Notes of a German Missionary.* (Madras, 1856.)

[405] *Vocabulary of the Dialect spoken by the Todars of the Nilagiri Mountains*, by the Rev. F. Metz, of the German Evangelical Mission. (Madras, 1857.)

[406] *Antiquities of the Neilgherry Hills*, by Captain H. Congreve, 1847. Also, Caldwell's *Comparative Dravidian Grammar*. The German missionaries believe that these cairns were the work of the Kurumbers, another wild hill tribe.

[407] Todars pay two taxes to Government in return, on female buffaloes and on grazing land, both small in amount.

[408] *Raggee*, however, is the least nourishing of all the cereals, although it forms the chief part of the diet of the poorer classes in Mysore and on the Neilgherries. In good seasons it yields 120-fold, but it is very poor fare.

[409] In 1807 Buchanan mentioned the Badagas of the Neilgherries, as gatherers of honey and wax in the hills south of Wynaad.—ii. p. 246 and p. 273.

[410] Literally "one stone village."

[411] The great Tamil scholar.

[412] *Hooli*, a tiger in the Badaga language; and *cul*, a rock or stone in Tamil and Canarese. *Pili* is a tiger in Tamil.

[413] Mr. Fowler, in his evidence before a Committee of the House of Commons, gave 2500 to 4000 feet as the most favourable elevation for the growth of coffee.

[414] There are 11,386 acres of land under coffee cultivation in Wynaad, 7358 owned by Europeans, and 4028 by natives: of these 7224 are liable to assessment, that is, the coffee-trees are in bearing.

[415] Besides a *jemmi* fee on Government land, of eight annas an acre.

[416] Cleghorn's *Forests and Gardens of Southern India*, p. 16.

[417] Several species of *Chinchonæ* flourish at altitudes from 8000 to over 10,000 feet above the sea, and within the region of frequent frosts.

[418] Karsten.

[419] Smyth's *Journey from Lima to Para*, p. 115.

[420] Dr. A. Smith's *Peru as It Is*, ii. p. 57.

[421] Mr. Spruce's *Report*, p. 27.

[422] Called *Cinchona excelsa* by Dr. Roxburgh, but excluded from the list of Chinchonæ by Dr. Wallich, who gave the plant its present name.

[423] In the *Mahabharata* the five Pandus, who contended with the 100 Kurus or vices, were—Yudisthira, the personification of modesty; and his brothers Arjuna, or courage; Bhima, or strength; Nakal, or beauty; and Sahadeva, or harmony. The conversation between Arjuna and the incarnate deity Krishna, in the *Bhagavat Gita*, an episode in the *Mahabharata*, is perhaps the finest passage in the whole range of Sanscrit literature.

[424] *Cæsalpinia sappan*, a handsome tree, with curiously-shaped pods. It yields a valuable dye.

[425] Called *jowaree*, in Bengalee; *jonna*, in Telugu; *yawanul*, in Sanscrit; and *doora*, in Egypt.

[426] *Dolichos lablab*, a kind of pulse much eaten by the poor people.

[427] Cotton (*Gossypium Indicum*) is called *parati*, in Tamil; *putti*, in Telugu; and *kurpas*, in Sanscrit.

[428] The former of these grains has already been mentioned. The latter is *Panicum spicatum*, or spiked millet. It is called *bajree*, in Guzeratee; and *kunghoo*, in Sanscrit; and is made into cakes and porridge.

[429] "The black cotton soil seems to have arisen from the decomposition of basalt and trap. When dry it is dark-coloured, and glistens from the presence of nearly pure grains of silica. It possesses extraordinary attraction for water, and forms with it a most tenacious mud."—*Dr. Forbes Watson.*

[430] "The district of Coimbatore lies opposite the great gap in the Peninsular chain between the southern slopes of the Nilgiri mountains, and the northern face of those of Travancor. Across this depression the S.W. monsoon has almost a free passage to the eastward; but the great elevation of the mountains on both sides, and the absence of any considerable hills in the district, cause the monsoon wind to pass over without depositing much of its moisture; and, though the climate is humid, the rainfall is very trifling. During the N.E. monsoon the hills of Salem intercept the moisture."—Hooker's *Flora Indica*, i. p. 132.

[431] Lindley's *Theory and Practice of Horticulture*, p. 487.

[432] "This is an assurance which no private tenant in any country, not even in England, has obtained."—*East India Company's Memorandum*, 1858, p. 17.

[433] *Koda*, a shade or umbrella; and *karnal*, a jungle.

[434] Literally "Fruit-hills."

[435] Yet I missed the *Berberis Mahonia*, which in the Neilgherries is not found beyond the limits of the S.W. monsoon.

[436] For short accounts of the Pulney hills, see—

1. *Memoir of the Varagherry Hills*, by Capt. B. S. Ward, *Madras Journal of Literature and Science*, Oct. 1837, vol. vi. p. 280.

2. *Observations on the Pulney Mountains*, by Dr. Wight, *Madras Journal*, v. p. 280.

3. *Report on the Pulneys*, by Lieut. R. H. Beddome, *Madras Journal*, 1857.

4. Sir Charles Trevelyan's *Official Tour in the South of India*. He says, "It is an important fact that, as regards much the largest portion of this tract, there is no claim to the soil which can interfere with the establishment of the most absolute freehold."

[437] For a very interesting account of the Anamallay hills, see *Forests and Gardens of South India*, p. 289-302, by Dr. Cleghorn, Conservator of Forests in the Madras Presidency.

[438] Tamil is spoken throughout the Carnatic, in the southern part of Travancore, and north part of Ceylon, by about 10,000,000 souls. Telugu, the first of the Dravidian languages in euphonious sweetness, is spoken in the Ceded districts, Kurnool, part of the Nizam's territory, and part of Nagpore; Canarese in Canara and Mysore; and Malayalam in Malabar. The whole Dravidian race numbers 30,000,000 souls. The Tamil, Telugu, and Malayalam languages have each a system of written characters peculiar to itself: the Canarese letters are borrowed from the Telugu.

[439] Caldwell's *Comparative Dravidian Grammar*. Preface, p. v.

[440] *Lectures on the Science of Language*, p. 341.

[441] Adam Smith says that numerals are among the most abstract ideas which the human mind is capable of forming. See a paper read before the Ethnological Society in Feb. 1862, *On the numerals as evidence of the progress of civilization*, by Mr. Crawford.

[442] Caldwell, p. 2.

[443] *Kolki* of the Periplus; perhaps *Kilkhar*, on the Coromandel coast, opposite Rameswaram.

[444] In Sanscrit.

[445] In 1802 a pot of Roman coins was dug up near Dharaparum, in Coimbatore, of the Emperors Augustus and Tiberius, with *Cæsarea* marked on them, the place where they were struck. Buchanan's *Travels*, ii. p. 318.

One coin, a Roman *aureus*, has been found in a cairn on the Neilgherry hills.—Captain H. Congreve's *Antiquities of the Neilgherry Hills*.

[446] The author of the Periplus of the Erythræan Sea mentions Nelcynda (Neliceram), Paralia (Malabar), and Comari (Cape Comorin), as under King Pandion (Regio Pandionis); and Dr. Vincent thinks that the Pandyan Kings of Madura lost Malabar between the time of the author of the Periplus and that of Ptolemy; because the latter does not allude to Pandion until Cape Comorin is passed. Chira is the modern Coimbatore, and the capital of the Chira state was at Caroor. The state of Chola is the modern Tanjore. The word *Pandya* is probably of Sanscrit origin, but the masculine termination of *on* is Tamil.

[447] "In Tamil few Brahmins have written anything worthy of preservation: but the language has been cultivated and developed with immense zeal and success by native Sudras."—*Caldwell*, p. 33. Tamil literature, now extant, dates from the eighth or ninth century: p. 68.

[448] Dr. Ainslie, in his *Materia Medica*, gives a list of twenty works by Aghastya, chiefly on medical subjects, some of them translated from Sanscrit.

[449] For a list of kings of Madura, of the Pandyan and Naik dynasties, see a paper in the Asiatic Society's Journals, by H. H. Wilson; from MS. collections of the late Colonel Mackenzie.

[450] Tanjore was seized by the Mahrattas in 1675. The last Naik sovereign of Madura was installed as a tributary of the Nawab of the Carnatic.

[451] Namely the *Michelia Champacca*, a golden-coloured flower with a strong aromatic smell, also dedicated to Krishna; the mango-flower-called *amra*; the *Pavonia odorata* with a sweet flower, called *bulla*; the *Strychnos potatorum*; and the *Mesua ferea*, a guttiferous plant, with a flower white outside, and yellow inside the tube, with a smell like sweet-briar.

[452] While on the subject of sacred Hindu plants, I may also mention the *soma* juice, so often alluded to in the Vedas, which comes from a leafless asclepiad (*Sarcostemma viminale*) with white flowers in terminal umbels, which appear during the rains, in the Deccan: the holy *kusa*-grass (*Poa cynosuroides*), made into ropes in the N.W. provinces: the peepul-tree, the banyan, the neem (*Melia Azadyraclita*): the *Cratæva religiosa*, specially sacred to Siva: the *Nerium odorum*, sacred to Vishnu and Siva: the *Cæsalpinia pulcherrima*, sacred to Siva: the *Guettarda speciosa*, sacred to Siva and Vishnu: the *Origanum marjoranum*, a labiate plant sacred to Vishnu and Siva: the *Caryophyllum inophyllum*, sacred to Vishnu and Siva: the *Pandanus odoratissimus*, sacred to Vishnu and Mariama, but offensive to Siva: the *Artemisia astriaka*, sacred to Vishnu and Siva: the *Ocimum sanctum* or *toolsu*, a labiate plant with a white flower, specially sacred to Vishnu and Krishna: and the *Chrisanthemum Indicum*, a yellow flower, sacred to Vishnu and Siva.

[453] Mr. Caldwell considers that these lines do not allude to any of the avaturs of the Hindu Deities, but that they are borrowed, in some unexplained way, from Christianity.

[454] In Fergusson's *Architecture*, i. p. 105, the hall is represented with an arched roof, in a sketch from Daniell's *Views of Hindostan*.

[455] There was a Portuguese Jesuit mission, with two Christian churches, established at Madura during the reign of Tirumalla Naik. It was founded by Robert de Nobilibus, a nephew of Cardinal Bellarmin, and the missionaries wore the sacred thread, declaring themselves to be Brahmins from the West.

[456] The Brahmins of course are of mixed blood, through intercourse with Tamil women. Children are therefore Sudras, and are not Brahmins until they are invested with the sacred thread.

[457] From *Parei*, a drum, as they act as drummers at funerals.

[458] Caldwell's *Comparative Dravidian Grammar*, Appendix, p. 491.

[459] *Proceedings of the South India Missionary Conference*, 1858, p. 283.

[460] *Reports connected with the duties of the Corps of Engineers of the Madras Presidency*, 1846, vol. ii., p. 108. *Report of Captain Bell*, p. 117.

[461] There was formerly a peculiar system of collecting land revenue prevalent in Tanjore and part of Tinnevelly, called *Oolungoo*, by which the Government demand was dependent on the current price of grain. A standard grain assessment was fixed on each village, and also a standard rate according to which the grain demand was to be commuted into money; but if prices rose more than 10 per cent. above the standard commutation rate, or fell more than 5 per cent. below it, the Government, and not the cultivator, was to receive the profit and to bear the loss. The advantage of the system was that the Government participated in the benefit of high prices with the cultivator, while the latter was relieved from loss when prices were much depressed.—Mill's *India in 1858*, p. 119.

This Oolungoo system was introduced into Tanjore in 1825. It was found that the system was fertile in fraud and corruption, especially in connection with the determination of the annual price, and with claims for alleged deficiency of produce. In July, 1859, the Government resolved to abolish the Oolungoo system, and to substitute a fixed money demand, similar to that which prevails in all other districts. By 1860 this change had been completed, both in Tanjore and Tinnevelly.—*Principal Measures of Sir Charles Trevelyan's Administration at Madras* (*Madras*, 1860), p. 55.

[462] The largest temple in Southern India, next to that of Madura.

[463] From *Kar*, black, and *ur* a town, in Tamil.

[464] Hooker's *Flora Indica*, i. p. 124.

[465] Ibid., i. p. 133.

[466] Dr. Cleghorn states that the Seegoor forest has been much exhausted by unscrupulous contractors. "It is important," he adds, "that it should be allowed to recover, as it is the main source of supply to Ootacamund for housebuilding purposes." Captain Morgan has been placed in charge of it, and it is hoped that the sale of sandal and jungle-wood will cover the expenses, while the young teak is coming on for future supply, P. 36.

[467] The areca-palm requires a low moist situation, with rather a sandy soil, either under the *bund* of a tank, or in a position otherwise favourable for irrigation. The seeds are put into holes six feet apart, and the tree comes into bearing in about eight years. It yields fruit for fifty years, and, when in full bearing, produces 1½ lbs. of nuts.

[468] The Lingayets are members of the *Vira Saiva* sect, or worshippers of Siva as the *Linga*, a representation of which they carry round their necks. The sect is numerous in the central and southern parts of the peninsula. It is of modern origin, having been founded by a Brahmin of Kalyan in the middle of the 12th century. Its members deny the sanctity of the Brahmins and the authority of the Vedas, recognize various divinities, and virtually abolish the distinction of castes and the inferiority of women. They are divided into *Aradhyas*, by birth Brahmins, and often well versed in Sanscrit literature; *Jangamas*, who have a literature of their own, written in Karnata and Telugu; and Bhaktas.—Wilson's *Indian Glossary*, p. 311.

[469] The whole population of Coorg is about 119,160.

[470] Namely, the *Amma Kodagas* or Cauvery Brahmins; the *Kodagas* or chief tribe; the *Himbokulu* or herdsmen; the *Heggade* or cultivators; the *Ari* or carpenters; the *Badige* or smiths; the *Kuruba* or honey gatherers; the *Kavati* or jungle cultivators; the *Budiya* or drawers of toddy from the *Caryota urens* palm; the *Meda* or basket-makers; the *Kaleya* or farm-labourers; the *Holeya* or slaves; and the *Yerawa* or slaves from Malabar, cheaper than cattle.

[471] *Coorg*, by Rev. H. Moegling. (Mangalore, 1855.)

[472] Observations by Dr. R. Baikie. *Madras Journal*, 1837, vi. p. 342.

[473]

1860-61.

Revenue of Coorg.		*Expenditure.*	
Land revenue	£14,727	General expenditure	£10,211
Excise and stamps	3,611	Public works	1,153
Income tax	98		
Miscellaneous	8,300		
	£26,736		£11,364

[474] Seemann's *Popular History of the Palms*, p. 134.

[475] Moegling's *Coorg*, pp. 74-77; also Buchanan's *Travels*, ii. p. 511, and Drury's *Useful Plants of India*.

[476] Cleghorn's *Forests and Gardens of South India*, pp. 126-44, where the official correspondence respecting *kumari* will be found.

[477] *Cleghorn*, p. 11. Poon spars are also obtained from *Stercula fœtida*, a tree with brownish flowers, emitting a most horrible smell.

[478] Hooker's *Flora Indica*, i. p. 126.

[479] The inhabitants of the Laccadive islands are Sooni Mussulmans. They have some songs commemorating the introduction of Islam 500 years ago, but do not know when the Beebee of Cannanore got possession. Menakoy, the largest island, is a mass of coral 5½ miles in diameter. The land is less than a mile wide, the rest being a reef encircling a large lagoon. Within a hundred yards of the reef there is no bottom. The lagoon, which abounds in turtle and fish, has three entrances from the sea, one of which has a depth of two fathoms. The soil of the island is a coarse powdered coral, with a little vegetable matter. It is quite flat, no part being destitute of vegetation; the south thickly covered with cocoanut-trees and underwood, and the north more sparingly. Rats abound, there are some cats, a few cows and goats, large grey cranes, ducks occasionally, and the mosquitos are fearful.

The population is 2500; of these 116 are *Malikans*, the aristocracy of the islands, who own vessels trading to Bengal. The *Koornakar*, or agent of the Beebee, is generally a *Malikan*; he collects rents, and superintends her traffic. The *Malikans* have the exclusive privilege of wearing shoes, live in large houses built round courtyards, and possess English quadrants, charts, compasses, and telescopes. Below them are 180 *Malummies*, or pilots, a rank obtained by merit. Then 1107 *Klasies*, forming the bulk of the population, who are small landed proprietors, go to sea for regular wages, but are very independent. Then 583 *Maylacherries*, or tree-climbers for hire. The head-men are elected by the people. The islanders have six or seven vessels fit for the Bengal trade, and three or four for coasting. They go with money to Goa and Mangalore for salt and rice, with coir to Bengal, with cocoanuts to Galle, and bring Calcutta cloths home.—Mr. Thomas's *Report*.

[480] The gross exports of cotton from the ports in the various districts of the Madras Presidency in 1859-60 were as follows:—

Vizagapatam	40,758	lbs. Valued at	£783
Gosavery	3,000	"	36
Krishna	198,670	"	1,591
Nellore	21,075	"	230
Fort St. George	7,960,368	"	128,648
Tinnevelly	18,562,546	"	274,380
Malabar	2,509,132	"	49,900
N. and S. Canara	33,264,498	"	504,905

Total	162,560,047	"	960,473

In 1860-61 the total export of cotton from Bombay amounted to 355,393,894 lbs.; of which 278,868,126 lbs. went to Great Britain.

In the same year the ports of Malabar and Canara sent 55,182,181 lbs. to Bombay.

[481] In lat. 15° N. the western ghauts are not more than 1100 feet above the sea.

[482] The trap formation of the northern part of the ghauts terminates in 18° N., and is succeeded by laterite.

[483] *Transactions of the Medical and Physical Society of Bombay for 1838*, i. p. 92.

[484] Or *Gnidia eriocephala* of Graham.—Dalzell's *Bombay Flora*, p. 221.

[485] Dalzell's *Bombay Flora*, p. 93.

[486] Ibid., p. 275.

[487] The following list of shrubs, trees, and ferns growing at Mahabaleshwur has been kindly furnished by Mr. Dalzell.

LIST OF SHRUBS AND TREES GROWING ON THE HIGHEST GROUND AT MAHABALESHWUR.

Eugenia Jambolanum.
Memecylon tinctorium.
Mæsa Indica.
Pygeum Zeylanicum.
Indigofera pulchella.
Actinodaphne (2 sp.).
Bradleia lanceolaria.
Elæagnus Kologa.
Osyris Wightiana.
Lasiosiphon speciosus.
Salix tetrasperma.
Callicarpa cana.
Strobilanthus asperrimus and callosus.
Ligustrum Neilgherrense.
Olea dioica and Roxburgiana.
Ilex Wightiana.
Maba nigrescens.
Diospyros (3 sp.)
Hopea spicata and racemosa.
Embelia ribes and glandulifera.
Notonia grandiflora.
Artemisia parviflora and Indica.

CHINCHONACEÆ.

Grumilea vaginans.
Pavetta Indica.
Ixora nigricans and parviflora.
Canthium umbellatum.
Vangueria edulis.
Santia venulosa.
Wendlandia Notoniana.
Hymenodictyon obovatum and excelsum.
Griffithia fragrans.
Randia dumetorum.

Lastrea densa and cochleata.
Nephrodium molle.
Sagenia hippocrepis.
Athyrium filix fœmina.
Asplenium planicaule and erectum.
Diplazium esculentum.
Pteris quadrialata, lucida, and aquilina.
Campteria Rottleriana.
Adiantum lunulatum.
Cheilanthes farinosa.
Polypodium quercifolium.
Pleopeltis nuda.
Pœcilopteris virens.
Leptochilus lanceolatus.
Acrostichum aureum.
Lygodium scandens.
Osmunda regalis.

[488] Every Hindu wears a sect-mark on his forehead. These marks are thick daubs of white earth, red ochre, or sandal-wood, and there are several forms according to the different sects. The grand distinctions are between worshippers of Vishnu and Siva, the latter wearing his mark horizontal, and the former perpendicular. Any conical or triangular mark is a symbol of the *linga*. Two perpendicular lines and a dot between, denotes a worshipper of Vishnu as Rama or Krishna, &c. &c.

[489] Cleghorn, p. 222. Dalzell, p. 86.

[490] Or *Euphorbia neriifolia*. Dalzell, p. 226.

[491] *Account of the village of Lony*, by T. Coats. *Transactions of the Bombay Literary Society*, 1823, vol. iii. p. 172.

[492] The *cumboo* of the Madras Presidency (*Holcus spicatus*).

[493] The *cholum* of Madras (*Sorghum vulgare*).

[494] The natives of India are supplied, by Nature, with an endless variety of condiments to season their food, many of them growing wild. In the different parts of India I noticed as many as twenty-five ingredients used in curries and porridges. The tender leaves and legumes of the *agati* (*Agati grandiflora*); oil from the *elloopa* fruit (*Bassia longifolia*); young unripe gourds of the *Benincasa cerifera*; the *papaw* fruit; cocoanut-oil; the leaves of *Canthium parviflorum*; capsicums; cinnamon; leaves of *Cocculus villosus*; turmeric; cardamoms; *jhingo* (*Luffa acutangula*); the fruit of *Momordica charantia*; green fruit of *Morinda citrifolia*; the legumes of the horse-radish-tree (*Hyperanthera Moringa*); the plantain; the tender shoots of the lotus; the pickled seeds of a *Nymphæa*; the leaves of *Premna latifolia*; berries of *Solanum verbascifolium*; legumes of *Trigonella tetrapetala*; the white centre of the leaf culms of lemon-grass; the *Lablab cultratus*; onions; the fruit of *Sapota elingoides* in the Neilgherries; the *moong* (*Phaseolus mungo*); and many other pulses.

[495] The ploughs, and the carts on wheels bringing home the food from the fields, are mentioned in the 1st Ashtaka of the Rig Veda.

[496] Dr. Forbes Watson has made some very interesting calculations on the amount of pulses rich in nitrogen, which must be added to rice and other cereals comparatively poor in that constituent, in order that the mixture may contain the same proportion of carbonous to nitrogenous matter as is found in wheat, namely six to one. (See Table, next page.)

The cereals which I saw growing in the peninsula of India, besides rice, maize, wheat, and barley, were:—

1. *Setaria Italica*, called *tennay* in Tamil, and *samee* by the tribes on the Neilgherry hills, which is the Italian millet. The seeds are used for cakes and porridge. In the Deccan it is only cultivated in small quantities for the ryot's own use, and seldom for market. The grain is very small.

2. *Panicum Miliaceum*, called *varagoo* on the Pulney hills, and *warree* in the Deccan: a small millet, generally sown broadcast on the sides of hills. In the Neilgherries it is used as an offering to the gods, mixed with honey, and wrapped in plantain-leaves.

3. *Panicum pilosum*, or *badlee*, will grow in the worst soil, but is not much cultivated, unless the rains happen to be too scanty for other crops. The seed is very small, forming a long hairy spike.

4. *Cynosurus corocanus*, or *ragee*, is a very prolific grain, and forms the staple food of the poorer classes in Mysore, and on the slopes of the ghauts. It requires a light good soil, from which the water readily flows. In the Deccan they raise it in seed-beds, and transplant when a few inches high. It is made into dark brown cakes.

5. *Holcus spicatus*, or spiked millet, called *cumboo* in Madras, and *bajree* in the Deccan, where it is the chief food of the inhabitants, and is considered very nutritious.

6. *Sorghum vulgare*, or great millet, called *cholum* in Madras, and *jowaree* in the Deccan. It is made into cakes and porridge, and the stalks, which contain sugar, are excellent fodder for cattle. It grows six or eight feet high, and soon exhausts the soil, so that two crops are never taken in succession.

7. *Sesamum Indicum*, or gingelee oil-plant, called *till* in the Deccan. Oil is expressed from the seeds, which are also toasted and ground into meal for food. In the Deccan it is sown on gravelly or red soil, and the plants grow three or four feet high. Presents of the seed, made up in little boxes, are exchanged by friends on the day that the sun takes its northerly declination; and they are also acceptable as offerings to the god Mahadeo or Siva.

With these seven grains, the following pulses are usually raised:—

1. *Cicer arietinum*, or Bengal gram, the seeds of which are eaten, and the oxalic acid, which exudes from all parts of the plant, is used as vinegar for curries.

2. *Dolichos unifloris*, or horse gram, with grey seeds, used for feeding horses and cattle.

3. *Dolichos sinensis*, or *lobia*, a twining annual, with large pale violet flowers. The seeds are much used for food.

4. *Cajanus Indicus*, pigeon-pea, or *toor*. A shrub three to six feet high, with yellow papilionaceous flowers. This is an excellent pulse, and makes a good peas-pudding.

5. *Phaseolus mungo*, black gram, or *moong*. A nearly erect, hairy annual, with greenish-yellow flowers. It is much cultivated, and is a very important article of food.

6. *Phaseolus rostratus*, or *hullounda*, a twining plant, with large, deep rose-purple, papilionaceous flowers, grown in Malabar, and other parts of the peninsula.

7. Another kind of *moong*, called *ooreed*, with black and white seeds.

8. *Lablab cultratus*, a twining plant, with white, red, or purple papilionaceous flowers; much cultivated in gardens, and used for food.

9. *Dolichos lablab*, or *bulla*, a twining plant of which there are several varieties. The seeds are much eaten by the poorer classes when rice is dear, and are reckoned a wholesome substantial food. Cattle are very fond of the stalks. One variety, with white flowers, is cultivated in gardens, supported on poles, forming arbours about the doors of houses. The pods are eaten, but not the seeds.

CEREALS.		PULSES TO BE ADDED.					
		Cicer Arietinum.	Phaseolus Mungo.	Phaseolus Aconitifolius.	Dolichos Sinensis.	Dolichos Uniflorus.	Cajanus Indicus.
Proportion of Carbonous to Nitrogenous Matter.	NAMES.	Proportion of Carbonous to Nitrogenous Matter.					
		3·8 to 1	2·8 to 1	2·7 to 1	2·7 to 1	2·7 to 1	3·2 to 1
13·7 to 1	Ragee . . 100 parts	114 parts	62 parts	59 parts	59 parts	59 parts	78 parts
11·1 to 1	Rice . . . 100 „	92 „	50 „	47 „	47 „	47 „	63 „
8·5 to 1	Jowaree . 100 „	57 „	31 „	29 „	29 „	29 „	39 „
8·5 to 1	Maize . . 100 „	57 „	31 „	29 „	29 „	29 „	39 „
8·1 to 1	Tennay . 100 „	50 „	27 „	26 „	26 „	26 „	35 „
7·6 to 1	Bajree . . 100 „	41 „	22 „	21 „	21 „	21 „	28 „
7·3 to 1	Barley . . 100 „	34 „	19 „	17 „	17 „	17 „	23 „
6·4 to 1	Warree. . 100 „	12 „	6 „	6 „	6 „	6 „	8 „

[497] Built in 1749 by the Peishwa Balajee Bajee Rao.

[498] "The cultivation of the chinchona-trees may succeed in localities not appearing to offer exactly the same conditions regarding climate and the general character of the country as are peculiar to their native forests."—*Report by Dr. Brandis* (Supplement to the *Calcutta Gazette*, August 31, 1861), p. 467.

[499] "Mr. McIvor deserves great credit for the manner in which he has laid out the garden. It is both a beautiful pleasure-ground, and a valuable public institution for the improvement of indigenous, and the naturalisation of foreign plants; and it has been formed from the commencement by Mr. McIvor, with great industry and artistic skill, out of a rude ravine."—*Minute by Sir Charles Trevelyan*, Feb. 24th, 1860.

[500] *Cleghorn*, p. 318.

[501] *Cleghorn*, p. 180 and 359.

[502] I have supplied Mr. McIvor with the following works on the chinchona-plants:—

1. Weddell's *Histoire Naturelle des Quinquinas*.
2. Howard's *Nueva Quinologia de Pavon*.
3. Poeppig's *Notes on the Chinchona Trees and Barks of Huanuco*.
4. Karsten's *Medicinal Chinchona Barks of New Granada*.
5. Markham's *Report of a Visit to the Chinchona Forests of Caravaya*.
6. Spruce's *Expedition to procure Seeds and Plants of C. succirubra*.
7. Pritchett's *Report on the Chinchona Plants of Huanuco*.
8. Cross's *Report on the C. Condaminea*.
9. Junghuhn's *Cultivation of the Quina-tree in Java*, 1859.
10. *Botanical Descriptions of Species of Chinchonæ now growing in India.*

[503] *Order of the Madras Government*, July 3rd, 1861, No. 1328.

[504] *Secretary to the Government of India, to the Secretary to the Government of Fort St. George*, Dec. 9th, 1861.

[505] I sent a smaller parcel of C. Condaminea seeds in a letter, which arrived first at Ootacamund, in the middle of February. Sixteen days after sowing, twelve seeds were found to have germinated; and early in March 138 seedlings

were up, or 30 per cent. of the total number of seeds sown. The large parcel of seeds arrived at Ootacamund on March 4th, and were sown at once. See p. 570.

[507] The chinchona-plantations were commenced in Java in December 1854. On the 31st of December, 1860, they had of

C. Calisaya plants:	5510	in the germinating sheds.
	1806	planted out.
	1030	living cuttings.
C. lancifolia plants:	38	in the nursery sheds.
	42	planted out.
	28	living cuttings.
Total	8454	

Their other species is worthless.—Mr. Fraser's *Report*, p. 2.

[508] "It is the height of improvidence for the collectors to strip off the bark from the roots, thus securing a worthless product at the expense of any possible future renovation of the tree."—*Howard*.

[509] See chap. iii. p. 58.

[510] This is provided for in Java by placing a shed over the young plants.

[511] Mr. McIvor informs me that the winter of 1861-62 was the coldest he has experienced since he came to the Neilgherry hills, a period of fourteen years.

[512] Spruce's *Report*, p. 23.

[513] Howard, *Nueva Quinologia*, Nos. 2 and 7.

[514] Cross's *Report*, p. 5.

[515] See also Weddell's *Histoire Naturelle des Quinquinas*, p. 32.

[516] Mr. Howard thinks that the alkaloids are formed in the barks, by a reaction between ammonia and chinchotannic acid. The alkaloids are pure in the bark of the branches, somewhat less so in that of the trunk, and most impure in that of the roots.—*Microscopic Observations*, p. 2.

[517] Howard.

[518] Spruce's *Report*, p. 83.

[519] Ibid., p. 27. See also *Karsten*, p. 20.

[520] *Karsten*, p. 20.

[521] Spruce's *Report*, p. 23.

[522] Lindley's *Theory and Practice of Horticulture*, p. 70.

[523] In quills from large branches there is more alkaloid than in the smaller branches: in the bark of the trunk the proportion is still further increased, but this diminishes in quantity and deteriorates in quality in the bark of the roots.—*Howard*.

[524] Mr. McIvor reports the thickness of the bark of some of the young plants at Ootacamund to be nearly a quarter of an inch. The bark of quills of *C. Calisaya* given me by Mr. Howard, as samples from a lot on sale, is only one-eighth of an inch in thickness.

[525] The only reason why the value of quill-bark is much less than that of *tabla*-bark is that the former is usually mixed with spurious barks. Otherwise the value of quill-bark would only be about threepence per lb. less than *tabla*-bark.

[526] Cinnamon is one of the plants which, like the chinchonæ, are cultivated solely for their bark. Mr. Thwaites, the Director of the Botanical Gardens in Ceylon, has supplied me with a few particulars respecting the cultivation of cinnamon. The young shoots are peeled twice during the year, at a particular period of growth, when the bark comes off readily. This time is known at once by the peelers, from the appearance of the young shoots, and the process of peeling is then a very expeditious one, with practised hands. Young plants are raised from seeds in nurseries, and planted six feet apart, when they are a foot or eighteen inches long. They will commonly bear peeling in three or four years after being transplanted, if in a favourable locality and properly attended to. The roots are earthed up frequently, to keep the soil loose and free from weeds. In 1858, 750,744 lbs. of cinnamon were exported from Ceylon, worth 37,537*l.* There are forty-nine cinnamon-gardens in the island.

[527] Mr. McIvor observes that the leaves of all the chinchona-plants at Ootacamund are exceedingly bitter to the taste, and he suggests that these leaves, which naturally fall off the trees in succession, may be turned to account by being imported to England as a substitute for hops in the manufacture of beer. They would no doubt prove a healthy ingredient in beer, but it remains to be proved whether their bitter would preserve it as well as hops.

[528] "Attacked with violent tertian ague, and without any medicine, in Pampa-yacu, I made use of the green bark direct from the chinchona-tree, which I peeled from one growing a few hundred steps distant; and although, in consequence of unavoidable exposure in the rainy season, and the very great exhaustion after eight months' wild forest life, the disease returned on three occasions, it was each time conquered within a week. The very unpleasant additional effect, in this case, of the green bark, of producing obstinate obstructions, demands consideration. It might be well obviated by a plentiful addition of Epsom salts to the infusion. After the first dose of this fresh and unadulterated remedy, a sensation of general well-being is felt, and after recovery, on the first excursion, one approaches the healing trees with warm feelings of gratitude, whose beautiful reddish blossoms appear in such quantities in January, and their round crowns can be distinguished at a distance."—Poeppig, *Reise*, ii. p. 223.

[529] *Histoire Naturelle des Quinquinas*, p. 13.

[530] "From the unfitness of the 'Grey Bark' species for the production of quinine, comparatively small good will be likely to result from their naturalisation."—Howard, *Introduction*, p. xiii.

[531] *Quinine and Antiperiodics in their Therapeutic Relations*, by Dr. J. Macpherson (Calcutta, 1856), p. 27.

[532] There are 477 coffee estates in Ceylon; and in 1858-59 the quantity of coffee exported was 601,595 cwts., valued at 1,488,019*l.* In the same year the revenue was 654,961*l.*, expenditure 594,382*l.*, value of imports 3,444,889*l.*, and of exports 2,328,790*l.*

[533] See Mr. Thwaites's *Report*, dated Peradenia, Sept. 28th, 1861.

[534] I have taken the following brief notices of Sikkim, Bhotan, and the Khassya hills, from Dr. Hooker's *Flora Indica*, and *Himalayan Journals*.

[535] *Flora Indica*, i., p. 178.

[536] *Ibid.*, i., p. 175.

[537] *Flora Indica*, i., p. 233. *Himalayan Journals*, ii., p. 277.

[538] *Report* by Dr. Brandis, *Supplement to the Calcutta Gazette*, August 31st, 1861, No. 55, p. 467.

[539] *Quinine and Antiperiodics in their Therapeutic Relations*, by Dr. J. Macpherson (Calcutta, 1856).

[540] *Macpherson*, p. 2.

FAMILY OF THE INCAS OF PERU.

Tierce in fess: on a chief azure, a Sun with glory or: on a fess vert, an eagle displayed between a rainbow and two serpents proper: and on a base gules, a castle proper.

MANCO CCAPAC . = Mama Ocllo Huaco.
A.D. 1021. — (1st Inca of Peru).
1062.—Sinchi Rocca . . . = Mama Cora Chimpo.
1091.—Lloque Yupanqui . = Mama Ccahuana.
1126.—Mayta Ccapac . . . = Mama Cuca.
1156.—Ccapac Yupanqui . = Mama Ccuri Hilipa.
1197.—Inca Rocca . . . . = Mama Michay Chimpo.
1249.—Yahuar Huaccac . = Mama Chicya Hilipa.
1289.—Huira Cocha Inca . = Mama Runtu.
1340.—Pachacutec Inca . . = Mama Anahuarqui.
1400.—Inca Yapanqui . . = Chimpo Ocllo.
1439.—Tupac Inca Yapanqui = Chimpo Ocllo. — Auqui Tupac Amaru.

Mama Rahua Ocllo = (1) Huayna Ccapac . . (2) = Mama Runtu. — Hualpa Tupac Yupanqui.
1475–1526.

Marcio Serra de Lejesamo = Beatriz.
Francisco Pizarro = Inez. — Martin Ampuero = Francisca.
1526-32.—Huascar.
Manco Inca . . . = ? (1532-53.)
Paullu Inca.
Garcilasso de la Vega = Isabel Yupanqui Nusta.
Francisca = Juan M. de Collantes.
Mencia = Alonzo de Soto.
Dominga = Hernandez Piedrahita.
Domingo Piedrahita.
Dr. Lucas Fernandez Piedrahita *Bishop and Historian.*

Maria Tupac Usca = Pedro Ortiz de Orue (Encomendero of Marna).
Catalina = Luis Justiniani.
Luis Justiniani.
Nicolo Justiniani.
Justo Justiniani.
Pablo Justiniani (Cura of Laris), ob. A.D. 1854.

1560.—Cusi Titu Yupanqui.
Don Martin Garcia Loyola = Clara Beatriz.
Don Juan Henriquez de Borja = Lorenza, Marchioness of Oropesa.
1553.—Sayri Tupac = Cusi Huarcay.
1562.—TUPAC AMARU INCA, ob. 1571.
Isabella Nusta = Cacique Condorcanqui.
Felipe Tupac Amaru.
José Tupac Amaru.
Pedro Tupac Amaru.
Garcilasso Inca de la Vega (*the Historian*).
Carlos Inca.
Melchor Carlos Inca (*Kt. of Santiago. Went to Spain*, 1602).
*Bartolomé Tupac Amaru (ob. 1783, aged 125).
Cacique Noguera.
*Francisco Noguera.
*Patricio Noguera.
*Diego Berdejo (a Spaniard) = Francisca Noguera.
Bartolome Quispi Atauchi.
Martin Titu Atauchi Inca.
Juan Ramos Titu Atauchi.
Juan Ramos Titu Atauchi.
Asencio Ramos Titu Atauchi.
Maria = Nicolas Sahuaraura.
Pedro Sahuaraura = Sebastiana (Cacique of Oropesa). Bustinza.
Dr. Justo Sahuaraura Inca (Archdeacon of Cuzco), ob. 1852.
Luis Ramos Titu Atauchi, 1853, *a lawyer in Cuzco.*

*Marcela Castro = Marcos Tupac Amaru.
*Francisco Tupac Amaru.
Blas Tupac Amaru.
Miguel Tupac Amaru = Rosa Noguera.
Cacique Titu Condori.
*Lorenzo.
*Simon.
Manuela = *Diego Cristobal Tupac Amaru.
*Cecilia = Pedro Mendagure.
*Andres Mendagure.
Cacique Bastidas of Abancay = Marcela Pallocahua.
*José Gabriel Cordorcanqui.
TUPAC AMARU INCA n. 1740, ob. 1781. = *Micaela Bastidas.
*Antonio Bastidas.
Miguel Bastidas.
*Hipolito, *n.* 1761, *ob.* 1781.
*Mariano, *n.* 1763, *ob.* 1783.
Fernando, *n.* 1770, *ob.* ?

* *Killed by the Spaniards*, 1780-1-2-3.

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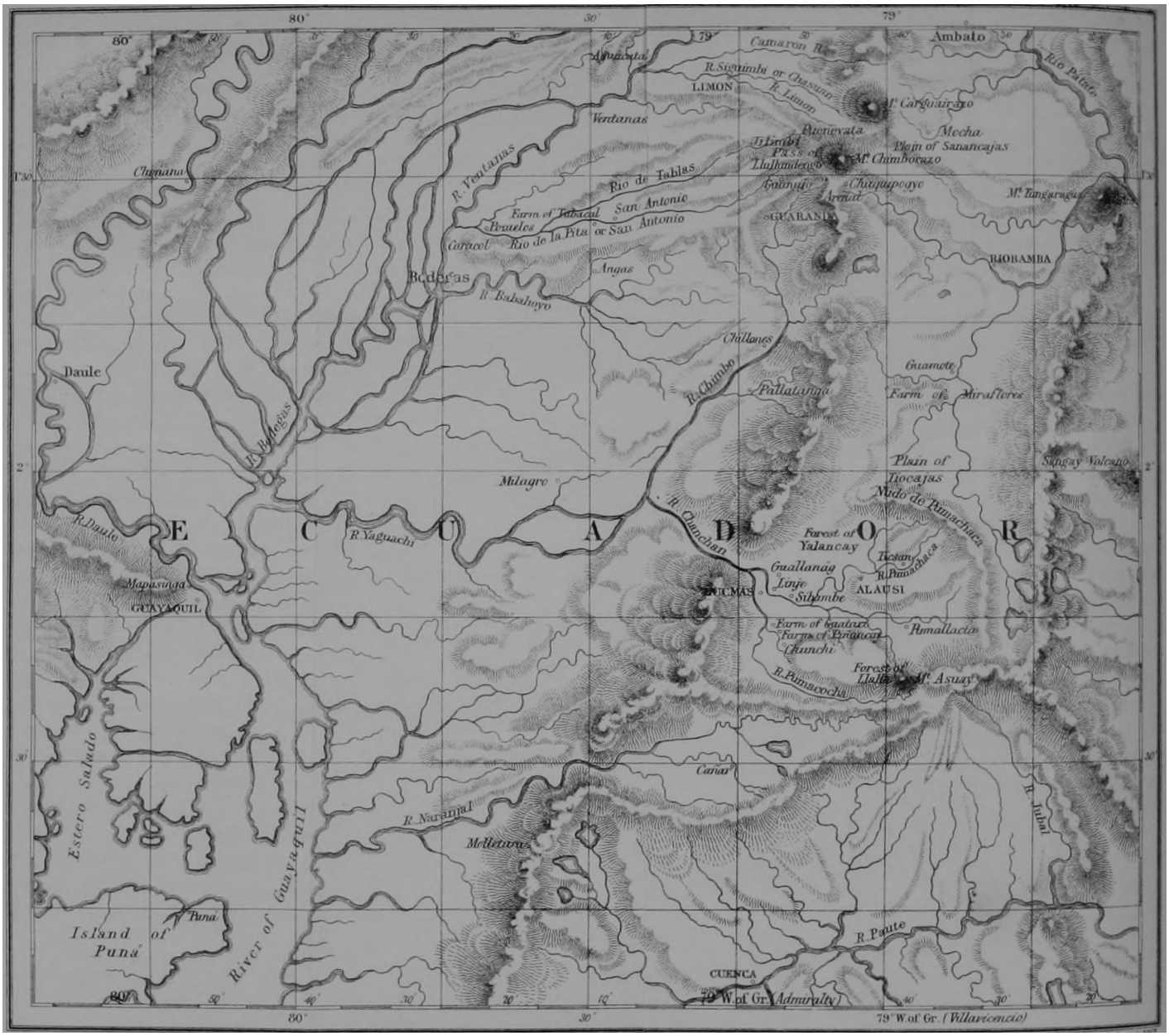

Ambato
Camaron R.
R. Siguimbi or Chasuan
LIMON
R. Limon
Mt. Carguairazo
Mocha
Plain of Sanancajas
Mt. Chimborazo
Ventanas
Chimana
R. Ventanas
Rio de Tablas
Farm of Tabacal
San Antonio
Rio de la Pita or San Antonio
Caracol
Bodegas
Angas
R. Babahoyo
GUARANDA
RIOBAMBA
Mt. Tungaragua
Chillones
R. Chimbo
Pallatanga
Guamote
Farm of Miraflores
Daule
R. Bodegas
Milagro
Plain of Tiocajas
Nudo de Pimachaca
Sangay Volcano
R. Daule
E C U A D O R
R. Yaguachi
R. Chanchan
Forest of Yalancay
Guallanag
Linje
Sibambe
ALAUSI
Mapasinga
GUAYAQUIL
Pumallacta
Chunchi
R. Pumacocha
Mt. Asuay
Estero Salado
Cañar
R. Naranjal
Molletura
R. Jubal
Island of Puná
Puná
River of Guayaquil
R. Paute
CUENCA
79° W. of Gr. (Admiralty)
79° W. of Gr. (Villavicencio)

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Monthly Reports of the Number and Growth of the Chinchona Plants on the Neilgherry Hills.

DATE.	C. SUCCIRUBRA.							C. Calisaya.	C. micrantha.	C. nitida.	C. Peruviana.	"Grey-bark" species without name.*	Growth of the seedlings of the "grey-bark" species.				C. CONDAMINEA.			C. lancifolia.	C. Pahudiana.	Total number of plants.
	Number of plants.	Average monthly growth.	Size of leaves.	Maximum monthly growth.	Height of largest plants.	Circumference of the stem of largest plants, at the ground.	Circumference of the stem of largest plants, 3 feet from the ground.						Average growth.	Maximum growth.	Size of leaves.	Height and breadth.	C. Uritusinga.	C. Chahuarguera.	C. crispa.			
1861.		Inches.	Inches.	Inches.	Ft. in.	Inches.	Inches.	Number.	Number.	Number.	Number.	Number.	Inches.	Inches.	Inches.	Inches.				Number.	Number.	
June 9	967	..	..	..	..	..	..	6	511	430	28	172	..	..	..	3 high.				..	..	2114
July 9	1204	1⅛	11 × 7	..	2 6	..	..	6	802	714	36	211	1¼	..	2½ × 1½	4½ high.				..	..	2973
Aug. 9	1517	1⅜	11⅛ × 7⅛	7	2 10	..	..	6	896	804	42	271	1½	2⅓	..	8⅓ by 7				..	..	3536
Sept. 9	2361	3	14⅜ × 10	8	3 2	..	..	6	905	840	42	298	2	3¼	..	13 by 10				..	..	4452
Oct. 9	3137	2⅛	15 × 10	11	3 6	..	..	6	905	854	58	298	1½	3¼	..	15 by 12				..	21	5315
Nov. 1	3477	2½	16½ × 10	11	3 9	..	..	6	963	917	58	314	1⅓	3¼	..	16 by 14				..	112	5847
Dec. 1	4762	2⅓	18 × 12	9	3 9	..	..	6	1228	917	64	314	1⅓	3⅛	..	16 by 15				..	175	7466
1862.																						
Jan. 1	5200	..	18 × 12	..	4 0	3⅛	..	59	1497	1050	64	314	..	..	..	..	A plant, 6 feet high, was despatched from England, for the Neilgherry hills, March 1862.	Upwards of 100,000 seeds arrived at Ootacamund in March 1862.	A small parcel of seeds arrived at Ootacamund in March 1862.	4	425	8613
Feb. 1	6580	..	18 × 12	..	4 6	3⅛	2⅛	67	1713	1000	60	308	..	..	..	..				4	425	10,157
Mar. 1	..	..	..	..	..	..	..	116	..	..	..	..	..	..	..	..	..	138	..	..	..	..
Apr. 1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4193	100	..	..	25,000

* This is a variety of *C. nitida*.

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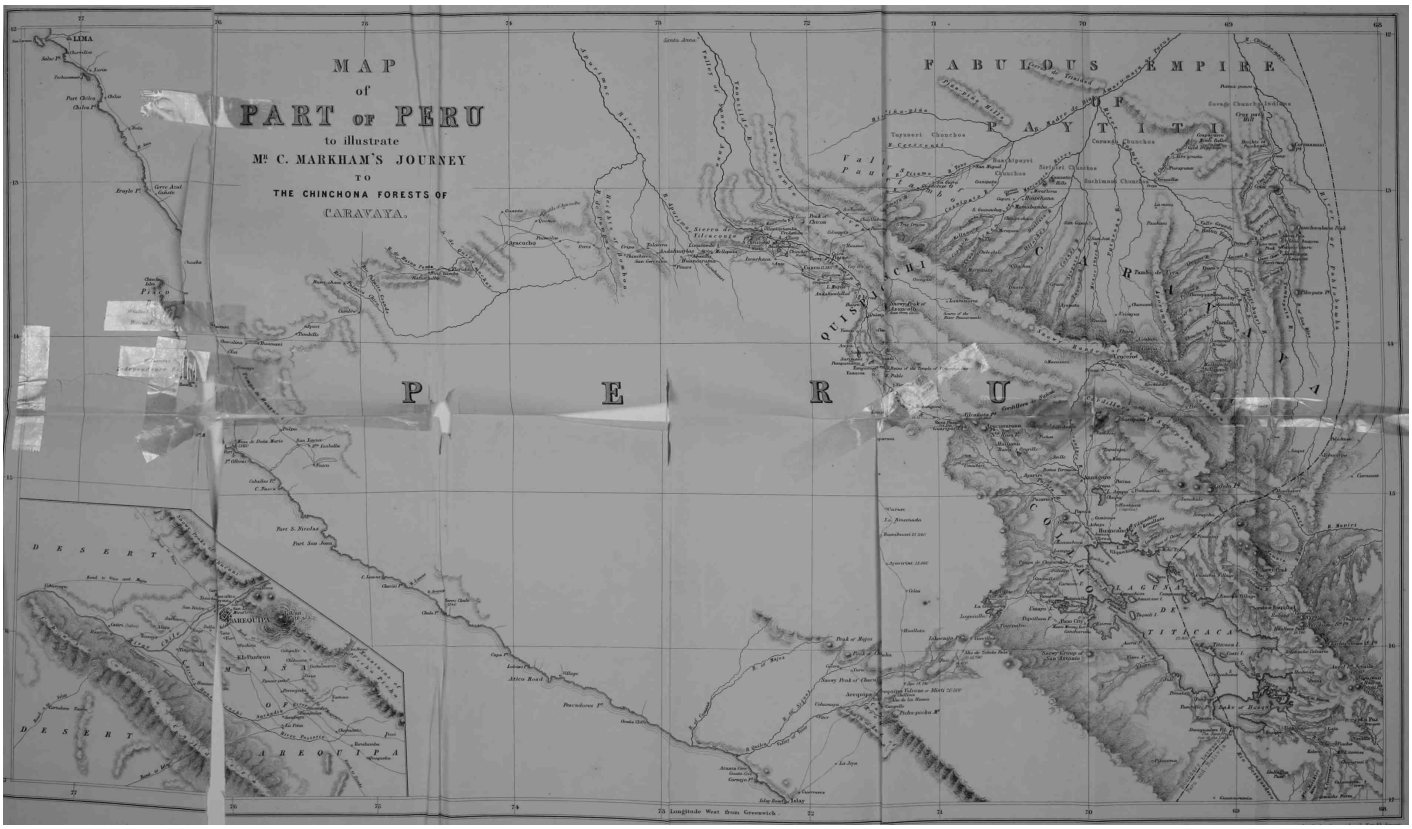
MAP
of
PART OF PERU
to illustrate
Mr. C. MARKHAM'S JOURNEY
TO
THE CHINCHONA FORESTS OF
CARAVAYA.
FABULOUS EMPIRE
OF
PAYTITI
PERU
LIMA
AREQUIPA
DESERT
LAGUNA DE TITICACA
Longitude West from Greenwich

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